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THE AFRICAN IN THE UNITED STATES.

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THE future of the African in the United States is, in the judgment of many, the gravest question of the day. It must, from its nature, swell in volume and thrust itself forward more and more; and though the evils as depicted in these pages be in their worst forms comparatively remote, yet, if there be real grounds for them, the time for action in seeking and applying a remedy lies in the present. The far-reaching and critical character of the subject demands that it should be approached without political bias, and treated solely from the point of view of the national welfare.

In this spirit the reader is referred to the tabulated figures on a succeeding page, derived from an analysis of the census of the United States, and of several of the Southern States, for each decade from 1830 to 1880 inclusive, and showing the rate per cent of increase or decrease of the white and the black population for the basis of the following discussion.

The very high rate of increase for the whites in the United States, in the first, second, and third decades, is due to a copious immigration adding itself to a lesser population. As the population of a country swells, and the immigration remains about the same, the rate per cent of increase falls.

The enormous rate of increase in several of the States, in the early decades, notably Arkansas and Mississippi, is altogether abnormal, and readily accounted for. These were then new regions, just opening to settlers, and the older slave States poured into their rich bosoms an overwhelming tide. Multitudes of whites, with and without slaves, like bees from a hive, swarmed forth from the older States, to settle in these cheap and productive parts. Hence it is that South Carolina,

for an example, shows, from 1830 to 1840, an increase of only one half per cent for the whites, and three per cent for the blacks, while for Arkansas the corresponding figures are two hundred and six per cent, and three hundred and thirty-two per cent. Only when States have been fairly settled, and peculiar causes affecting population removed, does an enumeration reveal the natural increase of a people; and this, as a wide and accurate observation in the United States has shown, can not be, under the most favorable circumstances, above thirty-five per cent—at least for the white race.

Thoughtful minds awaited with special interest the results of the census for 1880. It closed the first decade of freedom for the blacks; and whether this race, under its new conditions, was an increasing or decreasing one—whether it was increasing more rapidly than the whites, or otherwise—these were questions of critical and far-reaching importance.

It is seen that over the United States the gain for the whites has been twenty-nine per cent, that for the blacks thirty-four per cent, and that the latter is by much the highest figure reached by the blacks in the several decades. Referring to the figures of the last decade, belonging to the States, it is further seen that, while the gain in all these States, both for white and black, is remarkably high, the gain in several instances—as in the case of Arkansas, South Carolina, and Mississippi (for the blacks)—is too high to be credible, transcending as it does the natural procreative power of the most prolific race. (The reader will remember that from 1870 to 1880 the population of these States received little or no accession from immigration.) The gain in population, immediately succeeding a continued and desolating war, must be more or less abnormally large. It is readily accounted for by the separation of husbands and wives, the procrastination of marriage on the part of the young, and the prevailing destitution, at least comparative destitution, accompanying a state of war. But, with every allowance on these grounds, the rate of increase in the States just mentioned remains incredible, and either the census for 1870, or that for 1880, must be in error.

The error is doubtless in the former. The census for 1870 was made under the old law of 1850, a law which those well qualified to judge deem, in some important particulars, grossly defective. Again, the enumerators were, for the most part, negroes, often ignorant and inefficient; and it is on evidence that the enumeration of counties (at least as regards South Carolina) was not unfrequently made at court sessions and on muster-grounds, and not by a house-to-house canvass. The exceedingly high rate of increase in South Carolina as a State, and particularly in certain districts thereof, induced the Census Superintendent for 1880 to send thither a special agent, for the purpose of ascertaining the facts. Not all the State was canvassed, but enough to substantially verify the census for 1880; and this, with the further

consideration that the census for 1880 was made under a new and improved law, and by enumerators who, as a body, were thoroughly qualified, ought to be considered as settling the matter, and placing the error at the door of the preceding census. It is to be observed, in passing, that if the error, as practically it does, bears equally against white and black alike, however the figures for the two races, taken absolutely, may vary from the truth, yet are they still a proximate guide, considered relatively, to the comparative rate of increase of the races.

(1.)

UNITED STATES.

	White.	Black.
1830 to 1840....	34 per cent.	23 per cent.
1840 to 1850....	38 "	23 "
1850 to 1860....	38 "	22 "
1860 to 1870....	24 "	9 "
1870 to 1880....	29 "	34 "

(2.)

ALABAMA.

	White.	Black.
1830 to 1840....	76 per cent.	114 per cent.
1840 to 1850....	21 "	35 "
1850 to 1860....	21 "	27 "
1860 to 1870....	1 " loss.	8 "
1870 to 1880....	27 "	26 "

(3.)

ARKANSAS.

	White.	Black.
1830 to 1840....	206 per cent.	332 per cent.
1840 to 1850....	111 "	133 "
1850 to 1860....	98 "	133 "
1860 to 1870....	11 "	9 "
1870 to 1880....	63 "	72 "

(4.)

SOUTH CAROLINA.

	White.	Black.
1830 to 1840....	½ per cent.	3 per cent.
1840 to 1850....	6 "	17 "
1850 to 1860....	6 "	5 "
1860 to 1870....	½ " loss.	1 " loss
1870 to 1880....	35 "	45 "

(5.)

NORTH CAROLINA.

	White.	Black.
1830 to 1840....	2 per cent.	1 per cent.
1840 to 1850....	14 "	17 "
1850 to 1860....	14 "	14 "
1860 to 1870....	7 "	8 "
1870 to 1880....	28 "	36 "

(6.)

MISSISSIPPI.

	White.	Black.
1830 to 1840....	155 per cent.	197 per cent.
1840 to 1850....	64 "	57 "
1850 to 1860....	19 "	40 "
1860 to 1870....	8 "	1½ "
1870 to 1880....	25 "	47 "

(7.)

LOUISIANA.

	White.	Black.
1830 to 1840....	77 per cent.	53 per cent.
1840 to 1850....	61 "	35 "
1850 to 1860....	39 "	33 "
1860 to 1870....	1 "	4 "
1870 to 1880....	25 "	33 "

(8.)

GEORGIA.

	White.	Black.
1830 to 1840....	37 per cent.	28 per cent.
1840 to 1850....	27 "	35 "
1850 to 1860....	13 "	20 "
1860 to 1870....	8 "	17 "
1870 to 1880....	27 "	32 "

It is estimated that five per cent from the rate of gain for the entire Southern blacks, as by census for 1880, is a fair allowance for this error, making their real gain about thirty per cent. Yet, as an obvious consideration points to the conclusion that the blacks will for the future develop in the South under conditions more and more favorable, it is not unreasonable to think that, in subsequent decades, this five per cent will be regained.

That consideration is the more complete adjustment of the black man to his new surroundings. His comparative helplessness imme-

diately after emancipation was a condition adverse to his increase. The absence of thrift, energy, and management, many think, marks negro character at its best. It is certain that the contraries to these qualities had, under a long condition of servitude, been abnormally developed. Emancipation found the negro without the master's care (and, as a body, slaveholders, at least from motives of self-interest, were humane), without the customary oversight and medical attention, dependent, not self-reliant. No wonder that many of the negroes have been worse off than under their former bondage; that the burden of life has been so often excessive; that infanticide has been so often resorted to, to lessen it; and that death from want and exposure has been so exceptionally frequent. A body of four million slaves, ignorant, uncivilized, and trained in habits of dependence, suddenly set free, then invested with the ballot, and intoxicated with political power, then checked, and in many instances violently checked, by the necessary and wholesome self-assertion of the white race, that they should have increased as they have done is astonishing, and can be accounted for only by the remarkable fecundity of the African. For the future the adverse influence to population, arising from this cause, will become less and less potent. The negro, adjusted to his surroundings, will work with more ease and effect. He is ascending from the lowest round. Education must give him increased power to accumulate, experience must improve his thrift, and, life passing under better conditions, it is reasonable to think that in subsequent decades he will add five per cent of increase to that of the past. We put this rate at thirty-five per cent.

The gain for the whites in the last decade is very nearly thirty per cent. This is to be docked in the Southern States to the extent of five per cent for the error in the census of 1870. Since, however, this error appertains only to the twelve million Southern whites, and the census in regard to the thirty million Northern whites is accepted as correct, the rate of increase for the total white population is a fraction under twenty-nine per cent. Of this at least nine per cent should be attributed to immigration. Immigration is now, and for a year or two past has been, largely in excess of this figure, but probably not for the past decade; and the resultant is a gain of twenty per cent for the entire native white population.

There is a wide, and, at first view, startling difference between the twenty per cent for the whites and the thirty-five per cent for the blacks. The solution is found in the superior fecundity of the latter. This superiority, while it belongs to the blacks as a race, is strengthened for them—1. As being the laboring class; 2. As laboring under favorable climatic conditions; that is to say, living in a semi-tropical region.

The laboring class is naturally the more fruitful class. In the case of a laboring woman the child-bearing period is greater by a

number of years than in one more delicately reared. Again, in estimating fecundity, the pain and danger attendant upon parturition are factors, and its comparative ease to the laboring woman, contrasted with the profound and long-continued prostration it brings to the lady of tender palms and jeweled fingers, is well known.

Again, the African on climatic grounds finds in the Southern country a more congenial home. In many districts there, and these by far the most fertile, the white man is unable to take the field and have health. It is otherwise with the African, who, the child of the sun, gathers strength and multiplies in these low, hot, feverish regions.

The wide advantage, therefore, in the rate of increase on the side of the African finds its solution in a superior natural fecundity, exerting itself under these favoring conditions.

Now mark the following: The white population, increasing at the rate of twenty per cent in ten years, or two per cent per annum, doubles itself every thirty-five years. The black, increasing at the rate of thirty-five per cent in ten years, or three and a half per cent per annum, doubles itself in twenty years. Hence we find:

Whites in United States in 1880 (in round numbers)	42,000,000
" " 1915 " "	84,000,000
" " 1950 " "	168,000,000
" " 1985 " "	336,000,000
Northern whites in 1880	30,000,000
" " 1915	60,000,000
" " 1950	120,000,000
" " 1985	240,000,000
Southern whites in 1880	12,000,000
" " 1915	24,000,000
" " 1950	48,000,000
" " 1985	96,000,000
Blacks in Southern States in 1880	6,000,000
" " " 1900	12,000,000
" " " 1920	24,000,000
" " " 1940	48,000,000
" " " 1960	96,000,000
" " " 1980	192,000,000

Our interest is in the progress of population in the Southern States, where the blacks almost altogether now are, and where they will continued to be massed more and more; and above stand the significant figures. These will be modified more or less by disturbing causes, the most prominent being immigration. But even should immigration ever take a pronounced Southern direction, yet immigration must slacken, and before many years practically cease, while the black growth must be perpetually augmenting, perpetually advancing its volume; and, every allowance being made, it is morally certain that in seventy or eighty years (as things now go) the blacks in every Southern State will overwhelmingly preponderate.

The second factor in our argument is the impossibility of fusion between whites and blacks. The latter have been, and must continue to be, a distinct and alien race. The fusion of races is the resultant from social equality and intermarriage, and the barrier to this here is insurmountable. The human species presents three grand varieties, marked off by color—white, yellow, and black. One at the first, in origin and color, the race multiplied and spread, and separate sections, settled in different latitudes, took on under climatic conditions acting with abnormal force in that early and impressionable period of the race's age—took on (we say) different hues, which, as the race grew and hardened, crystallized into permanent characteristics. Social affinity exists among the families of these three groups. The groups themselves stand rigidly apart. The Irish, German, French, etc., who come to these shores, readily intermarry among themselves and with the native population. Within a generation or two the sharpness of national feature disappears, and the issue is the American whose mixed blood is the country's foremost hope. *It can not be*—a fusion like this between whites and blacks. Account for it as we may, the antipathy is a palpable fact which no one fails to recognize—an antipathy not less strong among the Northern than among the Southern whites. However the former may, on the score of matters political, profess themselves special friends to the blacks, the question of intermarriage and social equality, when brought to practical test, they will not touch with the end of the little finger. Whether it be that the blacks, because of their former condition of servitude, are regarded as a permanently degraded class; whether it be that the whites, from their historic eminence, are possessed with a consciousness of superiority which spurns alliance—the fact that fusion is impossible no one in his senses can deny.

These, then, are the factors in our argument, and the source of the inferences to follow: 1. That the black population is gaining on the whites; 2. That the former is, and must continue to be, a distinct and alien people.

Two inferences follow—the first of a social character; the second, political:

1. The status of the black population, as a distinct and alien race, condemns the race to remain, *in perpetuum*, the laboring class. If its blood can not commingle with that of the whites, social advancement ceases at an early stage; the higher social planes are incapable of attainment; whereby is broken a fundamental social law that allows to the individual full freedom to rise or fall in the social scale, without hindrance from race prejudice or prestige.

That is the healthiest society which is the freest, which gives the fullest play to individual intelligence and energy; and in such a social state we note a tendency on the part of the rich upper class to sink, and the poor laboring class to rise; we observe therein a social cycle

at whose completion the rich and the poor, the upper and the lower orders, are found, as a whole, to have changed places. It is a law of slow action, but sure.

The causes are apparent. The sons of the rich eat daintily, exercise daintily, keep late hours for resting and rising, are self-indulgent and extravagant. There are, of course, exceptions. Undoubtedly, however, the surroundings of the sons of wealth create tendencies this way, toward effeminacy of body and uneconomical habits of mind. These are downward tendencies, and, pressing through a cycle of years, bring the descendants of the rich, as a class, to the social bottom.

The poor, on the other hand, are compelled, by their condition of life, to strength-giving exercise, and careful, saving methods in the management of means. Robust bodies and thrifty ways give upward tendencies, which, acting through the social cycle, lift the descendants of these poor to the higher planes. Taking men in the mass, tendencies and results are this way.

Now, as regards the blacks, this fundamental law is broken, and the issue, in a state of society theoretically free, is approaching disorder.

The blacks are an improving race, and the throb of aspiration is quickening. Progress with the pure African is, indeed, slow. How could it be otherwise? A long dark night of barbarous ignorance in his native land, succeeded on these shores by nearly a century of servitude, wherein letters were denied him, and improvident, unthrifty habits necessarily engendered, could rapid progress for the race, under these circumstances, be rationally expected? Advancement in mental training and in economic science must needs be slow—but there *is* advancement.

That portion of the colored population known as mulattoes show, in mind and manners, a marked superiority, drawn from the side of their white parentage. This element, though increasing among themselves, is not increasing (appreciably) from admixture of bloods; because the white man can not now cohabit with negresses with the impunity belonging to days of slavery. With all its gradations it still, however, forms a very large class. They mingle freely with the pure African on terms of perfect equality, have the African instinct, and make a great factor in determining the average progress of the race.

This laboring class, working upward along the social cycle, meets, almost on the threshold of development, an impassable barrier. With growing aspirations incapable of being realized, they are doomed to remain where they have been, and be hewers of wood and drawers of water. Individuals here and there, by force of peculiar talent and fortunate circumstances, break through the opposing obstacle, and attain high positions; or such positions may be conferred in the interest

of some political party. The heart knows, however, that the incumbents are recognized with an involuntary wince. They are tolerated by reason of their fewness. The mass of the blacks are held back in their state of toil. It is the mandate of American instinct.

We say *American instinct*—which is, that America is for Americans, not for German, Irish, or African, as such. The German here rises and rules, not as a German; nor the Irishman as an Irishman. When the German gets out his naturalization papers, he theoretically gets out of his German skin. Practically, he gets out of it in a generation or two, through intermarriage and association; mingles freely and equally with the mass of population; and, in the attainment of the highest social or political privilege or distinction, is limited solely by the worth of his individuality. The rise and rule of the African must be, according to American spirit, after the same method. Disappearing in the mass of population, he must lose the African cast, and transform himself, by intermarriage and social association, into an actual American; for he could be no American, however the letter of the law might read, who, after the lapse of a century, should retain the exclusive hue and affinity of a stranger race. But this transformation is impossible, seeing the blacks stand apart from the whites, and make a distinct and alien people. Any advancement of the blacks is an advancement of the African, as such; and the advancement of individuals, here and there, above the laboring level, is the vanguard of the race's advancement.

The advancement of the blacks, therefore, becomes a menace to the whites. No two free races, remaining distinctly apart, can advance side by side, without a struggle for supremacy. The thing is impossible. The world has never witnessed it, and *a priori* grounds are all against it. Hence, the whites instinctively oppose the black invasion (as it were), and seek to keep this people below the labor-line; and a large superiority, at present, in numbers, and a vastly larger superiority in intelligence and wealth, make them easily, and perhaps without conscious effort, successful.

But a fundamental social law is thus broken—a law, under whose operation, in a free social state, the poor, lower, laboring class naturally rise, while the rich upper class descend; and no law, whatever the sphere to which it belongs, can be broken with impunity. To the discontent arising from this source may be traced the periodic exodus movement among the negroes. Politicians, for party ends, have assigned other causes, and declared that "exodus" means bull-dozing, Ku-kluxing, imposition, oppression, enforced pauperism, etc. These are all wide of the mark. Since the Southern States have been under the rule of its intelligent population, the blacks, as a whole, and in the main, have been free in the exercise of political rights; and, moreover, they have prospered as never before. The underlying cause of the exodus fever, stimulated to some extent by railroad men and other side

agencies, is the broken social law obstructing the upward tendency of the laboring class. Naturally they are uneasy and restless at the prospect of being held perpetually in one place, and made the bottom caste under a social status professedly free. Hence, these periodical upheavals and outflowings toward Kansas, Indiana, etc., in expectation of relief hoped for in vain; for there, too, they are no less a distinct and alien race, and the same broken social law bears its issues.

But what will the upshot be, when the black population, advancing on the white, finally outnumbers it? The outlook is most serious. It is a repetition of the Israelites in Egypt, a lower and laboring class gaining in population on the upper, and, as a distinct and alien race, causing apprehensions to the Egyptians. There is a point at which mere numbers must prevail over wealth, intelligence, and prestige combined. Unless relief comes, when that point approaches, woes await the land. This dark, swelling, muttering mass along the social horizon, gathering strength with education, and ambitious to rise, will grow increasingly restless and sullen under repression, until at length conscious, through numbers, of superior power, it will assert that power destructively, and, bursting forth like an angry, furious cloud, avenge, in tumult and disorder, the social law broken against it.

2. Treatment of the political aspect of our subject follows a similar line of thought, and must needs be brief.

We take it for a certainty that a distinct and alien race like the blacks will always, in the main, vote together. Why they all are now Republicans is readily seen. But should present political parties break up, and others be formed on new issues, the blacks would still naturally go as a body. The circumstances under which they live here, compelling them to stand together socially, will also morally compel them to stand together politically. Confined injuriously by a social barrier, they may be expected to develop abnormally the natural race-instinct, and, under a powerful *esprit de corps*, cast a solid ballot.

It is here to be said that we regard it as a mistake, both for the country and for the interests of the Republican party (and this we say with complete freedom from political bias), that the enfranchisement of the blacks followed immediately upon emancipation. The glittering sentence in the inaugural of the late lamented President Garfield, that there is no middle ground between citizenship and the ballot, will scarcely bear examination. The ballot is not a natural right, but a trust, to be granted or withheld for cause. The free blacks, in the early part of the present century, were (if we mistake not) a voting body. Experience, however, showing that the ballot in their hands became a wide-spread source of corruption, and therefore an evil, the privilege was withdrawn. It was a mistake, we conceive, to have given this privilege to a people just freed from the bonds of slavery, and still characterized, as a whole, by profound ignorance;

and, that no greater harm has resulted is, because white intelligence has been able to exert a controlling influence and shape legislation. Certainly, while the whites were disfranchised, and the blacks politically supreme, the state of the South was intolerable. Had the Republican party, devoting its entire energies to the moral and intellectual elevation of the blacks, deferred their enfranchisement to a more reasonable day, when the race, in the mass, would be less unworthy of the ballot, the power of that party throughout the South would have been otherwise than it is to-day. The issue of the war had practically settled and silenced the old Democratic State-rights doctrine. Notwithstanding the war-engendered bitterness, a large white minority, if not a majority, at the South—partly the remnants of the old-line Whigs who antagonized the political tenets connected with the war's beginning, partly converts to results which force had imposed, partly recruits from moribund Democracy—these were ready, in good faith, to accept the new order of affairs, and act with Republicanism ; and if the Republican party, rejecting the mistaken policy of seeking a foothold in the South through negro suffrage, had fostered the friendly white element, it could easily have developed this element, aided by executive patronage extending through a series of terms, into overwhelming Republican strength. Under the course pursued the almost extinct Democratic party at once revived, from a pressing sense among the whites of self-preservation. The negroes voting as a body on one side, the whites necessarily became politically massed on the other. It made little difference under what name they rallied. The term "Democrat" had been opposed to Republican in days gone by, and was now adopted. Yet thousands, banded under this party title, had no sympathy with leading and distinctive Democratic doctrines, such as those regarding the tariff, finance, or State rights. They were against negro political supremacy, as meaning disaster to the land. It had prevailed for a short period (just after the war), and left desolation in its course. The ignorance and inexperience of this unlettered mass, fresh from slavery, were immensely unequal to the science of enlightened governing. For the whites it was a matter of life or death. They became a "solid South," as any other people, similarly circumstanced, would have become. Wealth and intelligence gave them the victory, as it ever will, where numbers approach an equality—a victory that does not mean injury to the blacks, but which is the pledge for good government and order—the proof whereof is the present peaceful and prosperous condition of the Southern States, for the blacks no less than for the whites, compared with their state of wretchedness, under negro political rule, in the days following immediately upon the close of the war.

We must again ask the question, What, from this stand-point, will the upshot be when the blacks numerically will so far exceed the whites as to overcome the vantage that the superior wealth and in-

telligence of the latter now give them? The outlook here is no less serious. Whatever civic capability the blacks may have, it is now in germ; whatever governing aptitude the race may possess, it is at present dormant. In the history of nations it has nowhere, as yet, been exhibited. If this race in the United States is improving, its improvement, as was to have been expected, is slow; and in every political virtue it will still be vastly below the whites, when in voting strength its fecundity will have put it vastly beyond them—so far beyond as to overcome every counter-influence, and give the political reins entirely into its hands.

Who can doubt that, when this day comes, the blacks will obey a race-instinct which all their surroundings will have powerfully tended to develop, and vote blacks alone into office? Thus have they done wherever the power existed. Kept, as they are, a distinct and alien race, no other issue is reasonably conceivable. And who can doubt that, under this state of affairs—an inferior and incompetent race completely dominating, by mere numbers, a superior one—the worse disorders would ensue? The whites would not submit, and a violent and disastrous conflict of races must follow. The whites would hold (1) that, while America is a nation governed by majorities, yet by those who framed the Constitution it was never intended that a race brought here as slaves, an inferior race, one kept distinct by this very inferiority, should, merely through a superior fecundity, become politically supreme, and lord it over the land. They would hold (2) that this political lordship would be ruinous to every interest; that for a short period subsequent to the close of the war it had partially prevailed, and with the unhappiest results; and that, should this lordship become distinctively fastened upon a large section of the Union, the incompetency of the negro to provide, legislatively, for the manifold and complex interests of an advanced civilization, would arrest its activities, paralyze its trade, and spread a decline throughout the entire country.

These are real and gigantic evils gradually looming up, and they merit the immediate and best attention of American statesmen.

Colonization, we conceive, is the remedy—a scheme which the far-seeing Henry Clay so warmly advocated, though it cost him the presidency. President Mr. Clay doubtless would have been had his opponents not raised against him the cry of being an abolitionist. But he was no abolitionist. He was a colonizationist. In the negro element, even in the relatively small proportions it bore in his day, his political sagacity saw an increasing danger. It was not only that the negro, while in bondage, made a breach between the free and the slave States (whereof the civil war was the issue), but his clear-sightedness saw evil in the presence of the negro as a negro, whether bound or free. The negro, he perceived, could not unite with any branch of the

whites, and in the mass of population lose race distinctiveness. He was compelled to stand off by himself, a separate and alien people. Like food incapable of digestion, and which lies in the stomach only stimulative of disease, he remained in the body politic a foreign element, without opportunity or power of assimilation, and a perpetual source of alarm. Hence, Mr. Clay advocated colonization; and happy would it have been for the country if his views had prevailed, and the slaves been bought up by the Government at an appraised rate, and transported either to their native land or to some section provided for them exclusively.

We have an impression that a move was made in Congress last winter by some Senator, looking to the acquisition of territory in Central America as a home for the blacks. Though nothing came of it, it is matter for rejoicing that Congressmen are turning their eyes this way. The sole ground whereon we favored ex-President Grant's project to buy San Domingo was that it would afford a home for our black population. Some home for them outside of this country must be provided at an early day, or ultimately their presence here will lead to complications and disorders of appalling character. The current news from the South, amid much that is cheering, strengthens our forebodings. There are a present peace and prosperity; but, to an attentive ear, mutterings of this storm are already beginning to be heard.

The republic is so rich and so prosperous, and its future, from some stand-points, so fair, that it seems invidious, perhaps, to mar the picture and reveal a frightful evil slowly developing in its bosom. Some would fain deem the danger imaginary; and, even when fully realized, the trouble, in its ultimate and worst forms, is comparatively so remote that there is a tendency to forget it, or at least to transfer its consideration to another day and generation. The remoteness of an evil, however, does not carry with it remoteness in applying the remedy. Let American statesmen of the present day be looking in the direction we have indicated. A subject so vast and so momentous it is the part of wisdom to regard before immediate threatenings *compel* consideration. Assuredly, the question will more and more thrust itself forward for solution. The black man is still the "irrepressible conflict." Great difficulties, under any circumstances, must attend its solution. Let it be solved while a peaceful adjustment is yet practicable, for there is a point beyond which the attempt to solve it would involve the rupture of the republic.

A PREHISTORIC CEMETERY.

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ABOUT ten miles from Cincinnati, along the Little Miami River, is a locality which has long been known to the country people as the "Pottery-Field." The ground was strewed with fragments of pottery, bones, arrow-points, and other remains of like character, and the place was generally considered to be the site of an ancient workshop. The primitive forest still occupies the locality, and is made up of oak, beech, elm, maple, walnut, etc. All around are found numerous mounds or tumuli, most of them small. A few of these were opened by Mr. Florian Gianque, in 1876, and some interesting things found. But, in 1878, Dr. Charles Metz and other gentlemen interested in archæology commenced a systematic exploration of the country thereabout, and so much has been found that we are enabled to form some idea of the habits, and get a glimpse into the life, of the people who once lived in the immediate vicinity of the city of Cincinnati.

During the four years that the excavations have been carried on, between six hundred and fifty and seven hundred skeletons have been brought to light. Many of them are in an advanced state of decay, and crumble to pieces on the slightest touch, while others, again, are in a very good state of preservation. It can, therefore, hardly be inferred that, because some of the skeletons are much decayed, they are necessarily very old; for, though we have well-preserved remains of bones from Babylon, Nineveh, and Egypt, which are certainly twenty-five hundred or three thousand years old, still the cases are exceptional in which they are found in good condition after the lapse of many years. Different kinds of soil and differences in climate have much to do with the matter: for, in a dry and equable climate, bones may resist for a long time the influences which would cause their decay, while, in a moist climate, and with sudden and extreme changes of temperature, such as we have here, any bone, unless buried in peat, or subject constantly to heavy pressure, so as to become partially fossilized, is liable to soon decay.

An examination of the skulls found in the cemetery, as it is called, as well as the other parts of the skeleton shows some interesting facts. In a paper by Dr. F. W. Langdon * is given a table of measurements of the crania which shows that the brachycephalous skulls (those with an index of breadth of ·800 and over) † are largely in the majority, there being fifty-two out of seventy-two of this character. None of them, however, exhibit any signs of the flattening of the frontal

* "Journal of the Cincinnati Society of Natural History," vol. iv, pp. 237, *et seq.*

† The long diameter being taken as 100.

bone, which is such a characteristic feature of the Natchez and other Southern races of Indians. The Caribs of the West Indies and the Chinooks of Oregon both flattened the heads of their children in infancy; and the skulls of the ancient Peruvians and the figures on the monuments at Palenque show a remarkable flattening of the frontal. This is generally considered to have been the natural form of the skull, to have been the type of beauty cultivated by the Peruvians, Central Americans, Toltecs, etc., and not to have been produced altogether by compression. The peculiar form of skull became hereditary, and children were born with this (to us) deformity.

Various forms of diseased bones are found among the human remains. One of these is a peculiar anchylosis of the spinous and articular processes of some of the vertebræ, the *bodies* remaining free.* It is supposed to have been the vertebral column of a female dwarf, the skeleton of which presented several other points of interest. Among the crania are several which have been fractured by some blunt implement, and the fracture has been partially or completely healed. Two other very interesting specimens are among the human bones. One is the eleventh dorsal vertebra, in which is imbedded for a quarter of an inch one of the small flint-points called war-arrows. The other specimen is a sacrum in which there is imbedded a similar point. This last was found in a pit with twenty-two skeletons,† and doubtless belonged to an individual killed with the others in a battle, all of the killed having been buried together. These specimens show with what force the people could send their arrows. Both had entered from the front of the body, passed through it, and were only stopped by the vertebral column. Some of the long bones exhibit various excrescences which have been referred to syphilitic diseases, and which show that the people here buried were afflicted with that fearful scourge which, as some one has expressed it, "turned Europe into a charnel-house."

But the bones of an extinct race of men, interesting though they may be, can tell us but little of their domestic habits, and it is to the implements found here that we turn with greatest interest. These are so abundant, and often of such a peculiar character, that we have much to speculate upon. First of all is the remarkable circumstance of finding so many implements of bone; the abundance of which has generally been thought to be a proof of a low grade of civilization. But probably their abundance or their rarity has been regulated also by the age of the deposit, for, the older the deposit, the less likely it is that the bone relics have resisted the action of time.

Many of the remains are of a peculiar character, unlike anything found elsewhere, and speculations in regard to their origin and use are

* For a figure of this and various other diseased bones, see article in "Journal of the Cincinnati Society of Natural History," vol. iv, pp. 241–257.

† Ibid., vol. iv, p. 253.

rife. Still other relics are strikingly like some found elsewhere, not particularly in this country, but in Europe, as will be shown further on. Among the most curious and anomalous of all are certain peculiarly grooved bones, as represented in Fig. 1.* They are usually made

Fig. 1.

of the leg-bones of the deer or elk. But few of the specimens are perfect, the majority having been broken by use and wearing away of the bone. The groove is often highly polished, though scratches running the long way are visible. These scratches were made in the manufacture or use of the instrument or tool, but what its use was no one has been able satisfactorily to determine. Archæologists are puzzled, and pronounce them to be unique. It has been supposed by nearly every one that they were used in dressing skins, but no such scratches as are observed could be made in that operation. Some have suggested that perhaps they were made to serve some purpose of ornamentation, but neither is this explanation probable. It seems to me that the groove has been the result of rubbing, for the purpose of polishing certain other relics found here. There have been found numbers of peculiar cylindrical pieces of bone and horn, like Fig. 2, as unlike anything found elsewhere as the grooved bones; and it seems probable that these cylinders of bone have been rubbed and polished in the grooved bones. We find that the different-sized cylinders fit well into the different-sized grooves, and certainly constant rubbing would both round off and polish the cylinders, and leave scratches in the groove. It has been a matter of speculation, also, to determine the use of these cylinders. Some have said that they were used in playing a game; but it is more likely that they were made into a belt for the waist, or a necklace, thongs being woven be-

Fig. 2.

* Copied from "Journal of the Cincinnati Society of Natural History," vol. iii., plate 1. Most of the figures herein given are made from specimens in the collection of the Cincinnati Society of Natural History.

tween them, first round one, then the next, and so on. None of them show any signs or attempts at boring from end to end.*

Deer and elk horns enter largely into the manufacture of many of the relics. Among others are what are known as bone arrow or spear

FIG. 3.

points, shown in Figs. 3 and 4. They are invariably made from the sharp points of horn, the piece being first cut off, and then a hole drilled into the blunt end with a flint. Marks made by the drill are still distinctly seen in the holes. The points were fastened to wooden shafts inserted in the holes. Now, strange though it may seem, relics

FIG. 4.

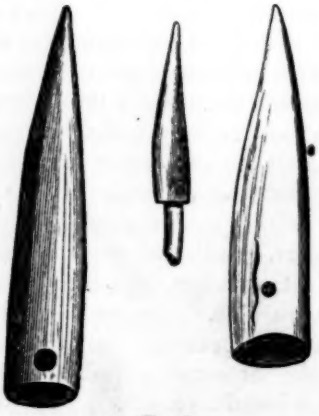

FIG. 5.

of an exactly similar make and of exactly the same sort of material are found thousands of miles away. Dr. F. Keller, in his elaborate book on the "Lake-Dwellers of Europe," gives figures† of these implements found in the Swiss lake-dwellings, and Fig. 5 is taken from his book. It is immediately seen that the relics from the two localities are identical, with the exception of the small hole drilled into the side. In Fig. 5 one of the arrow-points has a portion of the shaft still fastened in the hole.

Large pieces of deer and elk-horn, with the prongs polished by constant use, have probably been employed as digging implements. Smaller pieces of the flat part of the horn, with two or three prongs,

* Since this was written, Dr. Phené, of England, suggests that they were used as currency, and it is very possible that this was the case.

† See plates 45, 62, 89, and 91 for these figures. The ones here given are copied from Figs. 25 and 28 on plate 62, and Fig. 6 on plate 91.

like Fig. 6, have circular holes drilled into them, and were probably used for loosening the ground in agricultural labors. Here also we have similar pieces found in Switzerland, and Fig. 7 is copied from Dr. Kel-

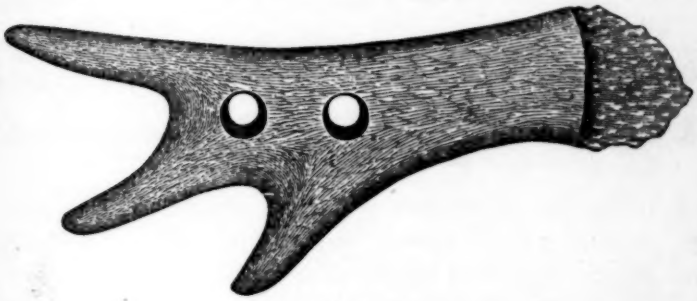

FIG. 6.

ler's book, before mentioned.* The same idea has evidently actuated the makers of both these articles. Still other implements of horn are known as skin-dressers. These are made of the broad bases of deer-horn, sometimes six or eight inches long and four inches wide. They

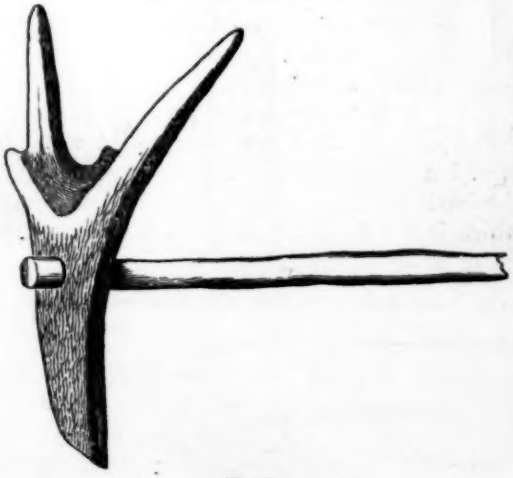

FIG. 7.

are polished at the broad end by constant use, so that they look like ivory. Occasionally one is found with a hole bored in it, but such are exceptional, and were perhaps used for another purpose. Here, again, we find relics of a similar character in Switzerland, as figured by Dr. Keller.†

Bone beads are also found with the other relics. These vary in length from one to three inches, and are often very highly polished.

* See plate 13, Fig. 2.

† See plate 13, Fig. 14.

Fig. 8 is a large one, and has some peculiar zigzag markings on it, the significance of which is not known. Bone fish-hooks, as represented

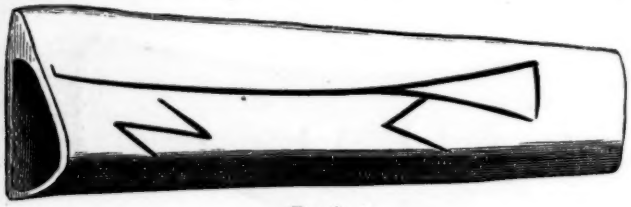

Fig. 8.

in Fig. 9, show the race to have lived by the product of the Little Miami River as well as by the chase. Bone harpoons, similar in make to those still in use by the Esquimaux,* show further that they derived sustenance from the river, while Fig. 10 shows a needle made of a fish-spine (*c*) with a large hole in one end, a deer-bone (*b*), used perhaps as an awl, and a turkey-bone (*a*), also used as an awl.

Fig. 9.

Besides the useful articles of bone that have been mentioned, there are others used more for ornament. The beads have already been referred to. A peculiarly-shaped piece of elk-horn, with five teeth and a perforated handle, has been found, and has been called a comb. Fig. 11† represents it, and a striking resemblance between it and one from the Swiss lake-dwellings (Fig. 12‡) may be noticed. Another piece, the use of which is not known, but which is supposed to have been

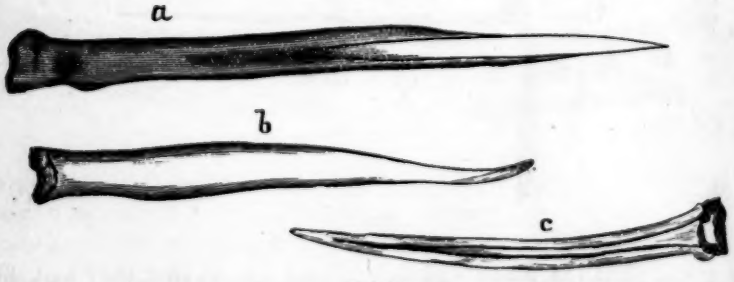

Fig. 10.

perhaps some sort of flute or whistle, is shown in Fig. 13. It is a hollow piece of bone, with six holes of different sizes made in one side,

* Lubbock, "Prehistoric Times," p. 504, Fig. 219.

† Copied from the "Journal of the Cincinnati Society of Natural History," vol. iii, p. 132.

‡ Keller, "Lake-Dwellings," plate 28, Fig. 8.

and marks of another where the relic has been broken. How much longer it was we can not tell. In Fig. 14 we have still another tube,

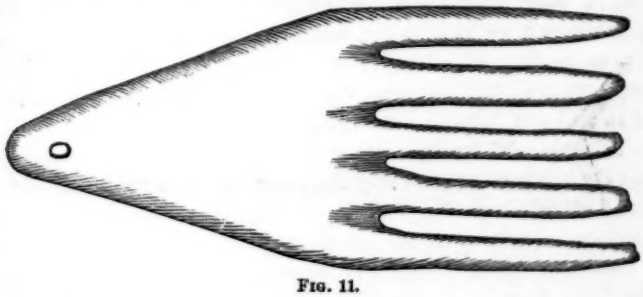

FIG. 11.

with only three holes, placed farther apart than in the preceding, and oblong instead of round; and in Keller* there is figured almost an

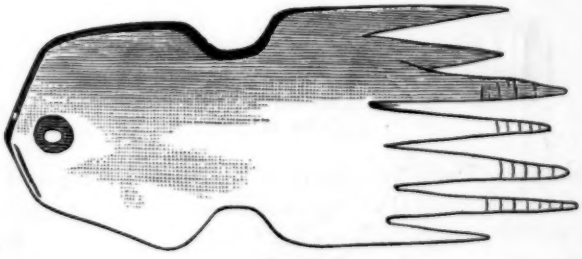

FIG. 12.

exact counterpart, except that the center hole is placed a little below the level of the other two. This last is called a weaver's shuttle, and, if our relic may be similarly named, we have evidence that weaving

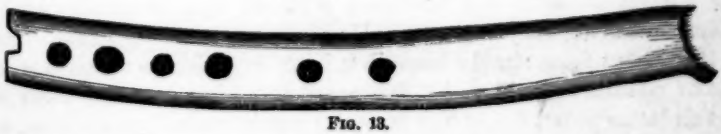

FIG. 13.

was another occupation of this people. And other facts are at hand to show that they did weave. Among the stone relics is one of those peculiar oblong pieces of polished slate which have sometimes gone by

FIG. 14.

the name of "gorgets." These pieces have one to three holes drilled through them, supposed to have been made to carry the object by. Still another and more probable purpose, however, is for weaving, the

* *Loc. cit.*, plate 41, Fig. 9.

holes being used to regulate the size of the thread. But all doubt vanishes when it is found that some "ash-pits," in which most of the relics have been found, contain pieces of coarse matting. This has been carbonized, so that it can not now be ascertained of what material it was made. Enough, however, remains to show that the fibers running one way are secured by twisted cords running across, and woven in and out between and around them.

As is very well known, the copper-mines of Lake Superior were extensively worked at an early day, and articles made of the copper are found all through the valleys of the Mississippi and Ohio Rivers. The present cemetery is no exception, for fragments of copper are quite common. The pieces are mostly small, however, and do not seem to have been in very general use. In all probability the metal was highly prized, and used simply for personal adornment. The most of the pieces are simply coiled or rolled, and Fig. 15 represents

FIG. 15.

common shapes. These two pieces still have the remains of a leather thong in them, showing that they had been used like beads. Another piece is a sort of copper bell, made of a single piece of metal, with a hole in the side, a handle, and a small piece of copper inside, which rattles when the bell is shaken. Still another large piece is like a cross with two arms, the use or purpose of it being entirely unknown. Objects like it have occasionally been found elsewhere. Squier and Davis* have figured a similar piece, but of silver, which they refer to the French Jesuits; and Professor Putnam figures another,† which differs in having only one arm. He considers it an ornament, "made in its present form simply because it is an easy design to execute, and one of natural conception." We must beg leave to differ from him in this latter point, for, if the design is one of natural conception, why do we make a point when it is found? Why are the forms like it not more numerous, and why does not the ornamented pottery have innumerable examples of it in the ornamentation?

Beads made of pieces of fresh-water and marine shells are found among the other remains. Sometimes pieces are cut from the mussel-shell, rubbed round, and then a hole bored. Sometimes specimens of *Melania* or *Paludina* had holes bored near the aperture, and were then used as beads. The beads made of marine shells show that some system of barter or commerce existed with the Atlantic Ocean or the Gulf.

* "Ancient Monuments of the Mississippi Valley," p. 208.

† "Eleventh Annual Report of the Peabody Museum of Archæology and Ethnology," p. 307.

Quantities of shells, of species of the genus *Unio*, "fresh-water oysters," are found. They go to show that shell-fish formed an article of diet of the race. And not only did they eat the animal, but they made good use of many of the shells. Many of them have been ground off at the edge, and were used as spoons or ladles, while others have holes punched in the valves, and were probably used for hoes in their agricultural operations. An examination of many of these shells shows no difference between them and individuals of the same species now found in the river. Still, a change could hardly be expected in the inhabitants of any locality, without a change in the conditions of life, and there is no evidence of a change in conditions since the shells were taken from the river.

The flint pieces, of various shapes, are quite numerous, and many of them beautifully worked. In Fig. 16 are shown some of the war arrow-points, and they are so abundant that one is almost inclined to believe the people who made them were not so peaceable as has been supposed. In Fig. 17 is shown one of the "leaf-shaped" flints, some of which are beautifully worked; while, in Fig. 18 are some of the drills used in boring holes in bones or shells. There is one thing to be noticed among the flint pieces. It is said that, in war, arrows like those in Fig. 16 were exclusively used, while, in hunting, points which were notched at the broad or lower end were used. Now, the peculiarity noticed is the scarcity of points of the latter character. For, out of 316 worked flints, selected from some thousands, there are but four which are notched at the lower ends. One of two things is to be inferred. Either that the race was more warlike than agricultural,

Fig. 16.

Fig. 17.

Fig. 18.

and used horn arrows in hunting instead of the notched ones; or else they were manufacturers of war-points for other tribes, and lived peaceably by hunting, fishing, and agricultural labors. All that we know could be interpreted more in favor of the first view than of the second, for, while we are sure they were agricultural to a certain extent, this fact would not be opposed to an argument for their warlike character. The Southern Indians, within the historic period, were at war all the time, and still raised quantities of maize.*

The fact of the race of people here buried raising maize is established by finding, in some pits, quantities of it completely carbonized. Corn seems to have often been placed in pots and buried with the bodies, to serve, perhaps, as food for the journey to the spirit-land. Another of their agricultural labors was that of raising tobacco; for, in common with nearly all the other North American races, they were smokers. Numbers of pipes, of various styles and materials, are found here. Some of them are of the red clay known as Catlinite, others of ordinary limestone. In Fig. 19 is shown a pipe carved out of hard

FIG. 19.

limestone. It is very highly polished, and considerable skill is exhibited in the carving of the head. It is evidently meant for a wolf, and the teeth, though interlocking in a peculiar way, are still tolerably true to nature in having the long canines.†

* Jones, "Antiquity of the Southern Indians," p. 7. "When, in 1730, the whites interposed their good offices to bring about a pacification between the Tuscaroras and the Cherokees, the latter responded: 'We can not live without war; should we make peace with the Tuscaroras, with whom we are at war, we must immediately look out for some other with whom we can be engaged in our beloved occupation.'" For notice of agricultural labors, see Jones, pp. 296 to 320.

† Many other forms of pipes from this locality are given in the "Journal of the Cincinnati Society of Natural History," vol. iii, Nos. 1, 2, and 3.

The stone implements are much the same as those found in various parts of the country. There seems, however, to be a remarkable paucity of grooved axes, there having been but two found so far. There are numbers of the ungrooved "celts," as well as of sling-stones, blunt at each end, but with a groove in the middle by which to fasten the handle. Some of these stones were also probably used as sinkers for nets in fishing, and are very similar to those found in Swiss lakes, as noticed by Dr. Keller. Rubbing-stones for polishing celts, hammers, anvils, pestles, and corn-pounders, are also abundant. Some pieces of a coarse, gritty sandstone have shallow grooves worn into them, which are supposed to have been used in rubbing down some of the bone or flint implements. Other pieces, with similar grooves, but made of close-grained sandstone, were probably used to straighten the shafts of the arrows. The shaft, at first wet and green, was rubbed up and down in the groove, and all the bends or twists thus taken out. Stones like these have been used by the Indians of the historic period.

Reference was made in the early part of this article to the name of the "Pottery-Field," given to the burying-ground. It may be inferred from the name that pieces of pottery were abundant, and the number of vessels taken out fully confirms the appropriateness of the name. These are all of one general shape and character. The material is a clay mixed with finely-powdered shells, and was baked in the sun. Nearly all the vessels are furnished with four handles, and are generally devoid of any ornamentation. Some have salamander-shaped handles, and the few that are ornamented have simply cross-lines and stripes with lines running round the vessel near the top, and perhaps a few dots. Though some of them are very well formed, they do not show any great advance in art.

FIG. 20.

Among the most interesting remains of any race of people, are the rude beginnings of art they have left behind them; and, though the people under consideration did not have, as far as we know, any written language, they have left a few memorials of their artistic feelings in the shape of some carvings on bone, and a few inscribed stones. The most interesting of these are here figured. Fig. 20 represents, on a piece of limestone, the head and forelegs of some curious animal. What is meant is hard to imagine. The teeth are marvelous, but still, in their arrangement, are like the teeth of the wolf-pipe in Fig. 19. Fig. 21 is a portion of a bone having peculiar marks cut on it. The marks are the same on

both sides, but the meaning intended to be conveyed is beyond the interpreting powers of the writer, nor does he know of any explanation having been attempted.

From the remains here described, and from others found in the cemetery, for such the locality undoubtedly was, we can form some

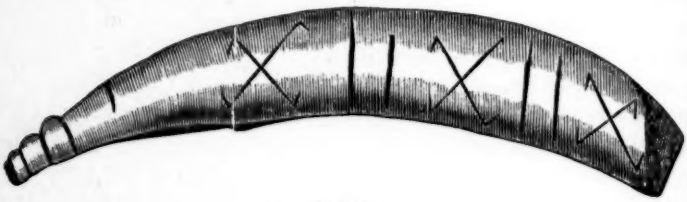

Fig 21.

idea of the habits of the people. They were warlike, yet agricultural, hunters as well as fishermen. They killed the bear, deer, elk, beaver, raccoon, and other animals of the forest, for the remains of all are quite abundant. They ate the shell-fish of the Little Miami River, and caught fish with hooks and nets. They raised corn, as well as tobacco, in quantities. They wove matting, made fish-nets, and perhaps blankets. They ornamented themselves with necklaces of bone and shell beads, bear and beaver teeth. They dressed in skins, prepared with horn and stone implements. They painted their bodies, as cakes of paint testify. They had commercial intercourse, or some system of barter, with Lake Superior and the Gulf, or the Atlantic. They were frequently embroiled in wars with neighboring tribes. They could hardly have been far advanced in civilization, if bone implements instead of stone is any indication. They had no written language, but yet left some record of their existence in the shape of carved bones and inscribed stones. Finally, if the burial of vessels containing food for the dead be any indication, they had some idea of a future life. Much further than this in their history we can not go.

The attention of the reader has been repeatedly called to the similarity between the implements found in this "Cincinnati" cemetery and those found in the Swiss lakes. No one could claim that, because of this similarity and almost identity of forms, the two races of people ever had intercourse with each other. But the fact is interesting as showing how, in two countries, thousands of miles apart, and separated by a period of hundreds of years in time, there were made, with the same materials, the same forms of weapons and implements. The resemblance is no argument for a common origin, but simply shows that nearly the same grade of civilization may be developed spontaneously in two widely separated countries.

It now becomes an interesting matter of speculation to discover the age of the cemetery. It has been referred to the age of the mound-builders, but, if so, it is a most remarkable fact, unless we con-

sider the modern Indians as the lineal descendants of the mound-builders, which is quite probable. Heretofore but three or four authentic skulls of the mound-builders have been found in any sort of preservation, while here we have a great many taken from a small area. Further, if we are to refer the cemetery to the mound-building race, we must admit that the race disappeared within a very recent period. On a level bank near the Little Miami River is a circular excavation about forty feet in diameter and seven feet deep. "An old settler relates that fifty years ago remains of stakes or palisades could be seen surrounding this excavation." * These have since disappeared, but their being there shows within how recent a period the ground was abandoned. Then the age of the forest-trees growing on the ground argues against any very great antiquity. The largest trees measured are a walnut fifteen and a half feet in circumference, an oak twelve feet, an oak and a maple each nine and a half feet in circumference, † equal to about five, four, and three feet in diameter respectively. Now, the average growth of fourteen different species of trees is about ·12 of an inch a year, or one foot radius (two feet diameter) in ninety-eight years. ‡ Taking this average, a tree five feet in diameter would be two hundred and forty-five years old; one four feet in diameter, one hundred and ninety-six years old; and one three feet in diameter, one hundred and forty-seven years old; or, in round numbers, two hundred and fifty, two hundred, and one hundred and fifty years respectively.

There is no evidence to show that there was any growth of forest on this ground, after its abandonment by the former residents, previous to the one now covering it. The roots of living trees having trunks two and three feet in diameter have been found penetrating the crania of skeletons found here, a tolerably sure indication of a first growth. Notwithstanding the assertions of many people to the contrary, the process of covering land with dense forest is by no means a slow one. A field allowed to go without being cultivated becomes in a few years covered with a new growth of saplings. Mr. Robert Ridgway, in a late paper, after referring to the cutting off of timber, and also to its encroachment on prairie-land in Illinois, says: "The growth of this new forest is so rapid that extensive woods near Mount Carmel [Illinois], consisting chiefly of oaks and hickories (averaging more than eighty feet high, one to nearly two feet in diameter), were open prairie within the memory of some of the present owners of the land." # Taking this fact into consideration, and remembering that

* "Prehistoric Monuments of the Little Miami Valley," by Dr. Charles Metz, "Journal of the Cincinnati Society of Natural History," vol. i, p. 123.

† Ibid., vol. iii, p. 44.

‡ See table, by Dr. A. Lapham, of age of trees in Wisconsin, given in Foster's "Prehistoric Races of the United States," p. 374.

"Notes on the Native Trees of the Lower Wabash and White River Valleys in

the largest tree found on the ground was not over two hundred and fifty years old, the time of the abandonment of the cemetery can not be more than three hundred years ago. This would take it back to less than one hundred years after the discovery of America by Columbus. The present State of Ohio was then probably occupied by a tribe of Indians known as the Eries, who were totally exterminated in 1656,* and it is possible we have in this cemetery one of the burial-places of this tribe of Indians.

Catlinite pipes were unknown to the mound-builders, yet some made of this material are found in this cemetery. Hogs rooting in the ground find sufficient nutriment in the bones to eat them greedily, and probably there would be fewer bone implements found if they had not been buried in ash-pits.† Everything, therefore, tends to show the comparatively recent date of this cemetery, and I would state, as a reasonable conclusion, that the remains are those of a tribe of Indians, perhaps the Eries, and were deposited not more than three hundred and perhaps only two hundred and fifty years ago.

THE UNIVERSITY IDEAL.‡

By ALEXANDER BAIN, LL. D.

GENTLEMEN: By your flattering estimate of my services, I have been unexpectedly summoned from retirement to assume the honors and the duties of the purple, and to occupy the most historically important office in the universities of Europe.

The present demands upon the rectorship somewhat resemble what we are told of the Homeric chief, who, in company with his council or senate, the *Boulē*, and the popular assembly, or *Agora*, made up the political constitution of the tribe. The functions of the chief, it is said, were to supply wise reason to the *Boulē* (as we might call our court), and unctuous eloquence to the *Agora*. The second of these requirements is what weighs upon me at the present moment.

Whatever may have been the practice of my predecessors, generally strangers to you, it would be altogether unbecoming in me to travel out of our university life for the materials of an address. My remarks, then, will principally bear on the UNIVERSITY IDEAL.

Illinois and Indiana," printed in "Proceedings of the United States National Museum," 1882, p. 54.

* "Some Early Notices of the Indians of Ohio," by M. F. Force, published by R. Clarke & Co., Cincinnati, 1879, pp. 1–11.

† For an account of these pits, see "Journal of the Cincinnati Society of Natural History," vol. iii.

‡ Rectorial Address to the Students of Aberdeen University, Wednesday, November 15, 1882.

To the Greeks we are indebted for the earliest germ of the university. It was with them chiefly that education took that great leap, the greatest ever made, from the traditional teaching of the home, the shop, the social surroundings, to schoolmaster teaching properly so called. Nowadays, we schoolmasters think so much of ourselves, that we do not make full allowance for that other teaching which was, for unknown ages, the only teaching of mankind. The Greeks were the first to introduce, not perhaps the primary schoolmaster for the R's, but certainly the secondary or higher schoolmaster, known as rhetorician or sophist, who taught the higher professions; while their philosophers or wise men introduced a kind of knowledge that gave scope to the intellectual faculties, with or without professional applications; the very idea of our Faculty of Arts.

So self-asserting were these new-born teachers of the sophist class, that Plato thought it necessary to recall attention to the good old perennial source of instruction—the home, the trade, and the society. He pointed out that the pretenders to teach virtue by moral lecturing were as yet completely outrivaled by the influence of the family and the social pressure of the community. In like manner the arts of life were all originally handed down by apprenticeship and imitation. The greatest statesmen and generals of early times had simply the education of the actual work. Philip of Macedon could have had no other teaching; his greater son was the first of the line to receive what we may call a liberal or a general education, under the educator of all Europe.

I must skip eight centuries to introduce the man that linked the ancient and the modern world, and was almost the sole luminary in the West during the dark ages, namely, Boëthius, minister of the Gothic Emperor Theodoric. As much of Aristotle as was known between the sixth and the eleventh centuries was handed down by him. During that time only the logical treatises existed among the Latins; and of these the best parts were neglected. Historical importance attaches to a small circle of them known as the Old Logic (*vetus logica*), which were the pabulum of abstract thought for five dreary centuries. These consisted of the two treatises or chapters of Aristotle called the "Categories," and the "De Interpretatione," or the theory of propositions; and of a book of Porphyry, the neo-Platonist, entitled "Introduction" (*Isagoge*), and treating of the so-called Five Predicables. A hundred average pages would include them all; and three weeks would suffice to master them.

Boëthius, however, did much more than hand on these works to the mediæval students; he translated the whole of Aristotle's logical writings (the "Organon"), but the others were seldom taken up. It was he too that handled the question of universals in his first Dialogue on Porphyry, and sowed the seed that was not to germinate till four centuries afterward, but which, when the time came, was to bear

fruit in no measured amount. And Boëthius is the name associated with the scheme of higher education that preceded the university teaching, called the *quadrivium*, or quadruple group of subjects, namely, arithmetic, geometry, music, and astronomy. This, together with the *trivium*, or preparatory group of three subjects—grammar, rhetoric, and logic—constituted what was known as the *seven liberal arts;* but, in the darkest ages, the quadrivium was almost lost sight of, and few went beyond the trivium.

In the seventh century, the era of deepest intellectual gloom, philosophy was at an entire stand-still. Light arises with the eighth, when we are introduced to the cathedral and cloister schools of Charlemagne; and the ninth saw these schools fully established, and an educational reform completed that was to be productive of lasting good results. But the range of instruction was still narrow, scarcely proceeding beyond the Old Logic, and the teachers were, as formerly, the monks. The eleventh century is really the period of dawn. The East was now opened up through the Crusades, and there was frequent intercourse with the learned Saracens of Spain; and thus there were brought into the West the whole of Aristotle's works, with Arabic commentaries, chiefly in Latin translations. The effervescence was prodigious and alarming. The schools were re-enforced by a higher class of teachers, lay as well as clerical; a marked advance was made in Logic and Dialectic; and the great controversy of realism *versus* nominalism, which had found its birth in the previous century, raged with extraordinary vigor. We are now on the eve of the founding of the universities; Bologna, indeed, being already in existence.

The university proper, however, can hardly be dated earlier than the twelfth century; and the important particulars in its first constitution are these:

First, the separation of philosophy from theology. To expound this, would be to give a chapter of mediæval history. Suffice it to say that Aristotle and the awakening intellect of the eleventh century were the main causes of it. Two classes of minds at this time divided the Church—the pious, devout believers (such as St. Bernard), who needed no reasons for their faith, and the polemic speculative divines (such as Abélard), who wished to make theology rational. It was an age, too, of stirring political events; the crusading spirit was abroad, and found a certain gratification even in the war of words. The nature of universals was eagerly debated; but, when this controversy came into collision with such leading theological doctrines as the Trinity and predestination, it was no longer possible for philosophy and theology to remain conjoined.

A separation was effected, and determined the leading feature of the university system. The foundation was philosophy, and the fundamental faculty the Faculty of Arts. Bologna, indeed, was eminent for law or jurisprudence, and this celebrity it retained for ages; but

the University of Paris, which is the prototype of our Scottish universities, as of so many others, taught nothing but philosophy—in other words, had no faculty but arts—for many years. Neither theology, medicine, nor law had existence there till the thirteenth century.

Second, the system of conferring degrees, after appropriate trials. These were at first simply a license to teach. They acquired their commanding importance through the action of Pope Nicholas I, who gave to the graduates of the University of Paris the power of teaching everywhere, a power that our own countrymen were the foremost to turn to account.

Third, the organization of the primitive university. Europe was unsettled; even in the capitals, the civil power was often unhinged. Wherever multitudes came together, there was manifested a spirit of turbulence. The universities often exemplified this fact; and it was found necessary to establish a government within themselves. The basis was popular; but, while in Paris only the teaching body was incorporated, in Bologna the students had a voice. They elected the rector, and his jurisdiction was very great indeed, and much more important than speechifying to his constituents. His court had the power of internal regulation, with both a civil and criminal jurisdiction. The Scotch universities, on this point, followed Bologna; and that fact is the remote cause of this day's meeting.

So started the university. The idea took; and, in three centuries, many of the leading towns in Italy, France, the German Empire, had their universities; in England arose Oxford and Cambridge; the model was Paris or Bologna.

Scotland did not at first enter the race of university founding, but worked on the plan of the cuckoo, by laying its eggs in the nests of others. For two centuries, Scotchmen were almost shut out of England; and so could not make for themselves a career in Oxford and Cambridge, as in later times. They had, however, at home, good grammar-schools, where they were grounded in Latin. They perambulated Europe, and were familiar figures in the great university towns, and especially Paris. From their disputatious and metaphysical attitude they worked their upward way:

"And gladly would they learn and gladly teach."

At length, the nation did take up the work in good earnest. In 1411 was founded the first of the St. Andrews' Colleges; 1451 is the date of Glasgow; 1494, King's College, Aberdeen. These are the pre-Reformation colleges; but for the Reformation, we might not have had any other. Their founders were ecclesiastics; their constitution and ceremonial were ecclesiastical. They were intended, no doubt, to keep the Scotch students at home. They were also expected to serve as bulwarks to the Church against the rising heretics of the times. In this they were disappointed; the first-begotten of them became the cradle of the Reformation.

In these our three eldest foundations we are to seek the primitive constitution and the teaching system of our universities. In essentials, they were the same ; only between the dates of Glasgow and Old Aberdeen occurred two great events. One was the taking of Constantinople, which spread the Greek scholars with their treasures over Europe. The other was the progress of printing. In 1451, when Glasgow commenced, there was no printed text-book. In 1494, when King's College began, the ancient classics had been largely printed ; the early editions of Aristotle in our library show the date of 1486.

Our universities have three well-marked periods ; the first anterior to the Reformation ; the second, from the Reformation to the beginning of last century ; the third, the last and present centuries. Confining ourselves still to the Faculty of Arts, the features of the pre-Reformation university were these :

First, as regards the teaching body. The quadrennial arts' course was conducted by so-called regents, who each carried the same students through all the four years, thus taking upon himself the burden of all the sciences—a walking encyclopædia. The system was in full force, in spite of attempts to change it, during both the first and the second periods. You, the students of arts, at the present day, encountering, in your four years, seven faces, seven voices, seven repositories of knowledge, need an effort to understand how your predecessors could be cheerful and happy, confined all through to one personality ; sometimes juvenile, sometimes senile, often feeble at his best.

Next, as regards the subjects taught. To know these you have simply to know what are the writings of Aristotle. The little work on him by Sir Alexander Grant supplies the needful information. The records of the Glasgow University furnish the curriculum of Arts soon after its foundation. The subjects are laid out in two heads—Logic and Philosophy. The Logic comprised first the three Treatises of the Old Logic ; to these were now added the whole of the works making up Aristotle's "Organon." This brought in the Syllogism and allied matters. There was, also, a selection from the work known as the "Topics," not now included in logical teaching, yet one of the most remarkable and distinctive of Aristotle's writings. It is a highly-labored account of the whole art of disputation, laid out under his scheme of the Predicables. The selection fell chiefly on two books—the second, comprising what Aristotle had to say on Induction, and the sixth, on Definition ; together with the "Logical Captions," or Fallacies. Disputation was one of the products of the Greek mind ; and Aristotle was its prophet.

Now for Philosophy. This comprised nearly the whole of Aristotle's Physical treatises—his very worst side—together with his Metaphysics, some parts of which are hardly distinguishable from the Physics. Next was the very difficult treatise—"De Anima," on the Mind, or Soul—and some allied psychological treatises, as that on

Memory. Such was the ordinary and sufficing curriculum. It was allowed to be varied with a part of the Ethics; but in this age we do not find the Politics; and the Rhetoric is never mentioned. So, also, the really valuable biological works of Aristotle, including his book on Animals, appear to have been neglected.

Certain portions of Mathematics always found a place in the curriculum. Likewise, some work on Astronomy, which was one of the quadrivium subjects.

All this was given in Latin. Greek was not then known (it was introduced into Scotland in 1534). No classical Latin author is given; the education in Latin was finished at the Grammar School.

Such was the Arts' Faculty of the fifteenth century: a dreary, single-manned, Aristotelian quadriennium. The position is not completely before us till we understand further the manner of working.

The pupils could not, as a rule, possess the text of Aristotle. The teacher read and expounded the text for them; but a very large portion of the time was always occupied in dictating, or "diting," notes, which the pupils were examined upon, *viva voce;* their best plan usually being to get them by heart, as any one might ask them to repeat passages literally, while perhaps few could examine well upon the meaning. The notes would be selections and abridgments from Aristotle, with the comments of modern writers. The "diting" system was often complained of as a waste of time, but was not discontinued till the third, or present, university dynasty, and not entirely then, as many of us know.

The teaching was thus exclusively *text* teaching. The teacher had little or nothing to say for himself (at least in the earliest period). He was even restricted in the remarks he might make by way of commentary. He was as nearly as possible a machine.

But, lastly, to complete the view of the first period, we must add the practice of disputation, of which we shall have a better idea from the records of the next period. This practice was coeval with the universities; it was the single mode of stimulating the thought of the individual student; the chief antidote to the mechanical teaching by text-books and dictation.

The pre-Reformation period of Aberdeen University was little more than sixty years. For a portion of those years it attained celebrity. In 1541 the town was honored by a visit from James V, and the university contributed to his entertainment. The somewhat penny-a-lining account is, that there were exercises and disputations in Greek, Latin, and other languages! The official records, however, show that the college at that very time had sunk into a convent and conventual school.

The Reformation introduced the second period, and made important changes. First of all, in the great convulsion of European thought, the ascendency of Aristotle was shaken. It is enough to mention two

incidents in the downfall of the mighty Stagyrite. One was the attack on him by the renowned Peter Ramus, in the University of Paris. Our countryman, Andrew Melville, attended Ramus's Lectures, and became the means of introducing his system into Scotland. The other incident is still more notable. The Reformers had to consider their attitude toward Aristotle. At first their opinion was condemnatory. Luther regarded him as a very devil; he was "a godless bulwark of the papists." Melanchthon was also hostile; but he soon perceived that Theology would crumble into fanatical dissolution without the co-operation of some philosophy. As yet there was nothing to fall back upon except the pagan systems. Of these, Melanchthon was obliged to confess that Aristotle was the least objectionable, and was, moreover, in possession. The plan, therefore, was to accept him as a basis, and fence him round with orthodox emendations. This done, Aristotle, no longer despotic, but as a limited constitutional monarch, had his reign prolonged a century and a half.

The first thing, after the Reformation in Scotland, was to purge the universities of the inflexible adherents of the old faith. Then came the question of amending the curriculum, not simply with a view to Protestantism, but for the sake of an enlightened teaching. The right man appeared at the right moment. In 1574 Andrew Melville, then in Geneva, received pressing invitations to come home and take part in the needed reforms. He was immediately made Principal of Glasgow University, at that time in a state of utter collapse and ruin. He had matured his plans, after consultation with George Buchanan, and they were worthy of a great reformer. He sketched a curriculum, substantially the curriculum of the second university period. The modifications upon the almost exclusive Aristotelianism of the first period were significant. The Greek language was introduced, and Greek classical authors read. The reading in the Roman classics was extended. A text-book on rhetoric accompanied the classical readings. The dialectics of Ramus made the prelude to Logic, instead of the three treatises of the Old Logic. The mathematics included Euclid. Geography and Cosmography were taken up. Then came a course of Moral Philosophy on an enlarged basis. With the Ethics and Politics of Aristotle were combined Cicero's ethical works and certain Dialogues of Plato. Finally, in the physics, Melville still used Aristotle, but along with a more modern treatise. He also gave a view of universal history and chronology.

This curriculum, which Melville took upon himself to teach, in order to train future teachers, was the point of departure of the courses in all the universities during the second period. With variations of time and place, the Arts' course may be described as made up of the Greek and Latin classics, with rhetoric, logic, and dialectics, moral philosophy or ethics, mathematics, physics, and astronomy. The little text-book of rhetoric, by Talon or Talæus, was made up of notes

from the Lectures of Peter Ramus, and used in all our colleges till superseded by the better compilation of the Dutch scholar, Gerard John Voss.

Melville had to contend with many opponents, among them the sticklers for the infallibility of the Stagyrite. Like the German Reformers, he had accepted Aristotelianism as a basis, with a similar process of reconciliation. So it was that Aristotle and Calvin were brought to kiss each other.

Melville's next proposal was all too revolutionary. It consisted in restricting the regents each to a special group of subjects; in fact, anticipating our modern professoriate. He actually set up this plan in Glasgow: one regent took Greek and Latin; another, his nephew, James Melville, took mathematics, logic, and moral philosophy; a third, physics and astronomy. The system went on, in appearance, at least, for fifty years; it is only in 1642 that we find the regents given without a specific designation. Why it should have gone on so long, and been then dropped, we are not informed. Melville's influence started it in the other universities, but it was defeated in every one from the very outset. After six years at Glasgow, he went to St. Andrews as Principal and Professor of Divinity, and tried there the same reforms, but the resistance was too great. In spite of a public enactment, the division of labor among the regents was never carried out. Yet, such was Melville's authority, that the same enactment was extended to King's College, in a scheme having a remarkable history—the so-called New Foundation of Aberdeen University, promulgated in a royal charter of about the year 1581. The Earl Marischal was a chief promoter of the plan of reform comprised in this charter. The division of labor among the regents was most expressly enjoined. The plan fell through; and there was a legal dispute fifty years afterward as to whether it had ever any legal validity. Charles I was made to express indignation at the idea of reducing the university to a school!

We now approach the foundation of Marischal College. The Earl Marischal may have been actuated by the failure of his attempt to reform King's College. At all events, his mind was made up to follow Melville in assigning separate subjects to his regents. The charter is explicit on this head. Yet, in spite of the charter and in spite of his own presence, the intention was thwarted; the old regenting lasted one hundred and sixty years.

Still the curriculum reform was gained. There was, indeed, one great miss. The year before Marischal College was founded, Galileo had published his work on mechanics, which, taken with what had been accomplished by Archimedes and others, laid the foundations of our modern physics. Copernicus had already published his work on the heavens. It was now time that the Aristotelian Physics should be clean swept away. In this whole department, Aristotle had made a

reign of confusion; he had thrown the subject back, being himself off the rails from first to last. Had there been in Scotland an adviser in this department, like Melville in general literature, or like Napier of Merchiston in pure mathematics, one fourth of the college teaching might have been reclaimed from utter waste, and a healthy tone of thinking diffused through the remainder.

A curious fascination always attached to the study of astronomy, even when there was not much to be said, apart from the unsatisfactory disquisition of Aristotle. A little book, entitled "*Sacrobosco* on the Sphere," containing little more than what we should now teach to boys and girls, along with the globes, was a university text-book throughout Europe for centuries. I was informed by a late King's College professor that the use of the globes was, within his memory, taught in the Magistrand Class. This would be simply what is termed a "survival."

Now, as to the mode of instruction. There were *viva-voce* examinations upon the notes, such as we can imagine. But the stress was laid on disputations and declamations in various forms. Besides disputing and declaiming on the regular class-work before the regent, we find that, in Edinburgh, and I suppose elsewhere, the classes were divided into companies, who met apart, and conferred and debated among themselves daily. The students were occupied, altogether, six hours a day. Then the higher classes were frequently pitched against each other. This was a favorite occupation on Saturdays. The doctrines espoused by the leading students became their nicknames. The pass for graduation consisted in the *propugning* or *impugning* of questions by each candidate in turn. An elaborate thesis was drawn up by the regent, giving the heads of his philosophy course; this was accepted by the candidates, signed by them, and printed at their expense. Then on the day of trial, at a long sitting, each candidate stood up and propugned or impugned a portion of the thesis; all were heard in turn; and on the result the degree was conferred. A good many of these theses are preserved in our library; some of them are very long—a hundred pages of close type; they are our best clew to the teaching of the period. We can see how far Aristotle was qualified by modern views.

I said there might have been times when the students never had the relief of a second face all the four years. The exceptions are of importance. First, as regards Marischal College. Within a few years of the foundation, Dr. Duncan Liddell founded the Mathematical chair, and thus withdrew from the regents the subject that most of all needed a specialist; a succession of very able mathematicians sat in this chair. King's College had not the same good fortune. From its foundation it possessed a separate functionary, the Humanist or Grammarian; but he had also, till 1753, to act as Rector of the Grammar School. Edinburgh obtained from an early date a Mathematical

chair, occupied by men of celebrity. There was no other innovation till near the end of the seventeenth century, when Greek was isolated both in Edinburgh and in Marischal College; but the end of regenting was then near.

The old system, however, had some curious writhings. During the troubled seventeenth century, university reform could not command persistent attention. But, after the 1688 Revolution, opinions were strongly expressed in favor of the Melville system. The obvious argument was urged that, by division of labor, each man would be able to master a special subject, and do it justice in teaching. Yet, it was replied that, by the continued intercourse, the masters knew better the humors, inclinations, and talents of their scholars. To which the answer was—the humors and inclinations of scholars are not so deeply hid but that in a few weeks they appear. Moreover, it was said, the students are more respectful to a master while he is new to them.

The final division of subjects took place in Edinburgh in 1708; in Glasgow, in 1727; in St. Andrews, in 1747. In Marischal College, the change was made by a minute of January 11, 1753; but, whether from ignorance, or from want of grace, the Senatus did not record its satisfaction at having, after a lapse of five generations, fulfilled the wishes of the pious founder. In King's College the old system lasted till 1798.

This closes the second age of the universities, and introduces the third age, the age of the professoriate, of lecturing instead of text-books, the end of disputation, and the use of the English language. It was now, and not till now, that the Scottish universities stood forth, in several leading departments of knowledge, as the teachers of the world.

The second age of the universities was Scotland's most trying time. In a hundred and thirty years, the country had passed through four revolutions and counter-revolutions; every one of which told upon the universities. The victorious party imposed its test upon the university teachers, and drove out recusants. You must all know something of the purging of the university and the ministry of Aberdeen by the Covenanting General Assembly of 1640. These deposed Aberdeen doctors may have had too strong leanings to episcopacy in the church and to absolutism in the state, but they were not Vicars of Bray. The first half of the century was adorned by a band of scholars, who have gained renown by their cultivation of Latin poetry; a little oasis in the desert of Aristotelian dialectics. It would be needless and ungracious to inquire whether this was the best thing that could have been done for the generation of Bishop Patrick Forbes.

Your reading in the history of Scotland will thus bring you face to face with the great powers that contended for the mastery from 1560: the monarchy, always striving to be absolute; the Church, whose position made it the advocate of popular freedom; the univer-

sities, fluctuating as regards political liberty, but standing up for intellectual liberty. In the seventeenth century the Church ruled the universities; in the eighteenth, it may be said that the universities returned the compliment.

Enough for the past. A word or two on the present. What is now the need for a university system, and what must the system be to answer that need? Many things are altered since the twelfth century.

First, then, universities, as I understand them, are not absolutely essential to the teaching of professions. Let me make an extreme supposition. A great naval commander, like Nelson, is sent on board ship, at eleven or twelve; his previous knowledge, or general training, is what you may suppose for that age. It is in the course of actual service, and in no other way, that he acquires his professional fitness for commanding fleets. Is this right or is it wrong? Perhaps it is wrong, but it has gone on so for a long time. Well, why may not a preacher be formed on the same plan? John Wesley was not a greater man in preaching than Nelson in seamanship. Take, then, a youth of thirteen from the school. Apprentice him to the minister of the parish. Let him make at once preparations for clerical work. Let him store his memory with sermons, let him make abstracts of divinity systems; master the best exegetical commentators. Then, in a year or two, he would begin to catechise the young, to give addresses in the way of exposition, exhortation, encouragement, and rebuke. Practice would bring facility. Might not, I say, seven years of the actual work, in the susceptible period of life, make a preacher of no mean power, without the grammar-school, without the Arts classes, without the Divinity Hall?

What, then, do we gain by taking such a roundabout approach to our professional work? The answer is twofold:

First, as regards the profession itself. Nearly every skilled occupation, in our time, involves principles and facts that have been investigated, and are taught, outside the profession; to the medical man are given courses of chemistry, physiology, and so on. Hence, to be completely equipped for your professional work, you must repair to the teachers of those tributary departments of knowledge. The requirement, however, is not absolute; it admits of being evaded. Your professional teachers ought to master these outside subjects, and give you just so much of them as you need, and no more; which would be an obvious economy of your valuable time.

Thus, I apprehend, the strictly professional uses of general knowledge fail to justify the grammar-school and the Arts' curriculum. Something, indeed, may still be said for the higher grades of professional excellence, and for introducing improved methods into the practice of the several crafts, for which wider outside studies lend their aid. This, however, is not enough; inventors are the exception. In

fact, the ground must be widened, and include, secondly, *the life beyond the profession.* We are citizens of a self-governed country; members of various smaller societies; heads or members of families. We have, moreover, to carve out recreation and enjoyment as the alternative and the reward of our professional toil. Now, the entire tone and character of this life outside the profession are profoundly dependent on the compass of our early studies. He that leaves the school for the shop at thirteen is on one platform. He that spends the years from thirteen to twenty in acquiring general knowledge is on a totally different platform; he is, in the best sense, an aristocrat. Those that begin work at thirteen, and those that are born not to work at all, are alike his inferiors. He should be able to spread light all around. He it is that may stand forth before the world as the model man.

All this supposes that you realize the position; that you fill up the measure of the opportunities; that you keep in view at once the professional life, the citizen life, and the life of intellectual tastes. The mere professional man, however prosperous, can not be a power in society, as the Arts' graduate may become. His leisure occupations are all of a lower stamp. He does not participate in the march of knowledge. He must be aware of his incompetence to judge for himself in the greater questions of our destiny; his part is to be a follower, and not a leader.

It is not, then, the name of graduate that will do all this. It is not a scrape pass; it is not decent mediocrity with a languid interest. It is a fair and even attention throughout, supplemented by auxiliaries to the class-work. It is such a hold of the leading subjects, such a mastery of the various alphabets, as will make future references intelligible, and a continuation of the study possible.

Our curriculum is one of the completest in the country, or perhaps anywhere. By the happy thought of the Senatus of Marischal College, in 1753, you have a fundamental class not existing in the other colleges. You have a fair representation of the three great lines of science—the abstract, the experimental, and the classifying. When it is a general education that you are thinking of, every scheme of option is imperfect that does not provide for such three-sided cultivation of our reasoning powers. A larger quantity of one will no more serve for the absence of the rest than a double covering of one part of the body will enable another part to be left bare.

Your time in the Arts' curriculum is not entirely used up by the classes. You can make up for deficiencies in the course when once you have formed your ideal of completeness. For a year or two after graduating, while still rejoicing in youthful freshness, you can be widening your foundations. The thing, then, is to possess a good scheme and to abide by it. Now, making every allowance for the variation of tastes and of circumstances, and looking solely to what is

desirable for a citizen and a man, it is impossible to refuse the claims of the department of Historical and Social study. One or two good representative historical periods might be thoroughly mastered, in conjunction with the best theoretical compends of Social Philosophy.

Further, the ideal graduate, who is to guide and not follow opinion, should be well versed in all the bearings of the Spiritual Philosophy of the time. The subject branches out into wide regions, but not wider than you should be capable of following it. This is not a professional study merely; it is the study of a well-instructed man.

Once more. A share of attention should be bestowed early on the higher literature of the imagination. As, in after-life, poetry and elegant composition are to be counted on as a pleasure and solace, they should be taken up at first as a study. The critical examination of styles, and of authors, which forms an admirable basis of a student's society, should be a work of study and research. The advantages will be many and lasting. To conceive the exact scope and functions of the imagination in art, in science, in religion, and everywhere, will repay the trouble.

Ever since I remember, I have been accustomed to hear of the superiority of the Arts' graduate, in various crafts, more especially as a teacher. Many of you in these days pass into another vocation—letters, or the press. Here, too, almost everything you learn will pay you professionally. Still, I am careful not to rest the case for general education on professional grounds alone. I might show you that the highest work of all—original inquiry—needs a broad basis of liberal study; or, at all events, is vastly aided by that. Genius will work on even a narrow basis, but imperfect preparatory study leaves marks of imperfection in the product.

The same considerations that determine your voluntary studies determine also the university ideal. A university, in my view, stands or falls with its Arts' faculty. Without debating the details, we may say that this faculty should always be representative of the needs of our intelligence, both for the professional and for the extra-professional life; it should not be of the shop, shoppy. The university exists because the professions would stagnate without it; and, still more, because it may be a means of enlarging knowledge at all points. Its watchword is progress. We have, at last, the division of labor in teaching; outside the university, teachers too much resemble the regent of old—having too many subjects, and too much time spent in grinding. Our teachers are exactly the reverse.

Yet, there can not be progress without a sincere and single eye to the truth. The fatal sterility of the middle ages, and of our first and second university periods, had to do with the mistake of gagging men's mouths, and dictating all their conclusions. Things came to be so arranged that contradictory views ran side by side, like opposing elec-

tric currents; the thick wrappage of ingenious phraseology arresting the destructive discharge. There was, indeed, an elaborate and pretentious logic, supplied by Aristotle, and amended by Bacon; what was still wanted was a taste of the logic of freedom.

CURIOSITIES OF SUPERSTITION.

By FELIX L. OSWALD, M. D.

II.

DURING the reign of Philip II of Spain, the Government spies in the province of Malaga made a curious discovery. In the highest valleys of the Alpujarras, and surrounded by a population of recently converted Moors, they found a tribe of mountaineers whose vernacular was as different from the Arabian as from the Spanish language, and whose neighbors believed them to be descendants of the ancient Iberians. The Ghabirs, as the Moors called them, were a most primitive and harmless race, their food consisted of the vegetable products of their peaceful valley, their only religious function in sacrificing milk and fruits to the spirit of the mountains. A few weeks after the discoverer had made his report to the Holy Office, a detachment of troopers and monks invaded the Alpujarras, the Ghabirs were dragged to Velez Malaga, and burned by order of the Grand Inquisitor. Their crime could not be condoned: they had disregarded the proclamation of 1562, and evaded tithes and baptism for seven years. In vain they pleaded their poverty, their ancient customs, and their ignorance of the Spanish language; "they were all invested with the *sanbenito*," says the chronicler, "and broiled to death with the proper ceremonies." The shrieks of the victims were heard at Loja, and for three days the harbor of Velez was filled with the stench of burned human flesh. It was a most edifying *auto da fe*—"an act of faith." The same faith had filled the Netherlands with blood and horror, had raged like the Black Death among the helpless aborigines of the New World, and had orthodoxed Spain by the systematic suppression of freedom, common sense, manhood, industry, and science.

And yet that monstrous superstition had undoubtedly supporters who honestly mistook it for the purest and most beneficent of all possible creeds. But we may be equally sure that mere ignorance would never have produced such delusions. The worst delusions are not the primitive ones, not the crude superstitions of a primitive people. The dogmas of an Ashantee rain-maker are harmless compared with those of a Spanish Inquisitor. We find priests and ignorance both in Ashantee and in Spain, but with this difference, that in Ashantee igno-

rance produces the priests, while in Spain the priests produce ignorance.

Henry Thomas Buckle holds that religions are influenced by the climate and topography of each country, and by the character of the inhabitants. "Barbarous creeds," says he, "are the result rather than the cause of a primitive stage of intellectual development. Superstition is merely the concomitant of the evils it seems to produce." The fallacy of the conclusion arises from the deficient specification of the premises; the logician overlooks the important difference between natural and factitious creeds; between local superstitions, produced by a process of natural development, like the customs and the language of a nation, and epidemic superstitions, engendered in the brain of a crazed visionary, and propagated by force and fanaticism. The former bear the marks of various national characteristics, the latter impress their own characteristics on each conquered nation. Natural superstitions reflected the poetical genius of the ancient Greeks and the warlike spirit of the Spanish Celts, but the national spirit of both Greece and Spain was crushed out by the dogmas of anti-naturalism. There are local superstitions that can not be exported; the myths of Brahmanism can not be separated from the physical geography of their East Indian habitat, while the *sagas* of the frost-giants and fur-clad hunter-gods could originate only in a frigid latitude. The Hindoo sticks to his rice, the Icelander to his whale-blubber. But poisons are more cosmopolitan: whisky and pessimism find votaries in every clime. The oldest creeds are the most harmless ones, for the superstitions of a primitive people are founded on natural impressions, which are not apt to mislead us to any dangerous degree. What harm could there be in the fancy of the Arcadian shepherd who heard a spirit-voice in the answering echo of his mountains, and ascribed the sudden stampede of his flock to the trick of a frolicsome faun? Bread-and-honey offerings to the fairies did not bankrupt the Hibernian peasant. Nearly all children of nature recognized the benevolent purpose in the gifts of the great All-Mother; the gods of antiquity were mostly helpful and beautiful spirits, while the nature-hating creed of the middle ages peopled the world with legions of hideous demons. The first May-night, when Hertha awakens the slumbering wood-spirits, became the *Walpurgis Nacht*, with its hellish revival-meetings. The satyrs became mountain-devils; St. Irenæus intimates that Jupiter Olympius was the disguised arch-fiend in person, the chief of evil spirits—nay, Ritter Tannhäuser does not hesitate to denounce the Goddess of Beauty to her face: "Frau Venus, schöne Gattin mein, Ihr seid eine Teufelinne" ("My lady, ye are a female devil"). The pantheon of the Mediterranean nations became a pandemonium, and in all Christian countries of mediæval Europe this devil-mania raged with a uniformity of violence and persistence that completely refutes Buckle's theory. From the fourth to the end of the fifteenth century fanaticism was clearly

not the result but the cause of ignorance. The dogma of unnaturalism raged like a pandemic disease, and the changes it suffered in its progress from Asia to Spain are altogether trifling compared with those it produced. Its influence leveled all national distinctions; it emasculated the valiant Visigoth and completed the degradation of the degenerate Byzantine; it increased the superstitions of Abyssinia and perverted the learning of Western Europe.

The works of Bodin, Sprenger, and Robert Burton furnish astounding proofs of what an amount of learning is compatible with the most extravagant superstitions. They were all three earnest lovers of Truth for her own sake—had accumulated stores of erudition that would break the intellectual backbone of a modern scholar; they were logicians of inexorable exactitude, but the very profoundness of their conclusions only reveals the bottomless absurdity of their premises.

Dr. Sprenger does not condescend to examine the reality of diabolical apparitions and infernal *liaisons*—it would be mere waste of time, he says, to discuss such well-proved facts—but applies the power of his logic to such questions as the following: If the offspring of a male devil and a human female can, by a proper course of penance, efface the stigma of his birth, can he be intrusted with the responsibilities of a municipal or subaltern clerical office? And, in case he should succeed in concealing his parentage and obtain ecclesiastical preferment, should not a conscientious diffidence at least inspire him to plead a *noli episcopari?* And if, by any chance, his—progenitor should appear to him, is he bound to treat the old gentleman with anything like filial respect? would he be obliged to exorcise his own father? or how could he compromise the difficulty? And what if he should find that he has inherited the paternal talent for magic arts, and can not rid himself of the fatal bequest—does the welfare of his soul require that he should denounce himself to the proper authorities? Persistent good luck, success in vaticination, etc., might be regarded as mere presumptive evidence, but if a Christian finds that he can fly, it would be a very suspicious circumstance; would he be justified in exercising his gift for worthy purposes—take a flit to Loretto, for instance, or should he fly straight to the king's attorney, and thus prove both his guilt and his contrition? Or if, by prayer and fasting, he should hope to disqualify himself for such exploits, would it be right to give himself the benefit of the doubt? An orthodox Catholic had better strictly abstain from volitation, but if such scruples were to seize him in mid-air, would it be advisable for him to let himself drop? The gift of prescience would also embarrass a man in that predicament—would it be right to conceal his foreknowledge if, by a timely hint, he could avert a public calamity? Reticence would, on the whole, be the safest plan. But should a man abstain from marriage, lest his wife might be less discreet? Persons troubled with a burdensome secret are apt to talk in their sleep.

Jean Bodine quotes St. Augustine to the effect that a certain Præstantius confided to him an adventure of his father's, who, having been drugged by a witch, was transformed into a horse, and had to carry a load of corn ("*De Civitate Dei*," xviii, 18). Such transformations, says Bodine, are still of daily occurrence, and only a false modesty prevents the victims from achieving the glory of exposing the enchanter.

Witches, it is well known, can change only the body, but not the soul, of a fellow-creature; the corn-carrying contemporary of St. Augustine was doubtless conscious of his degradation, and no horse of proper principles should hesitate, under such circumstances, to gallop away and state his case to the next exorcist. In Northern Germany, metamorphoses of that kind are especially frequent, the object of the wizards being to secure a mount on their way to the Blocksberg, and, though individuals have no jurisdiction in such matters, Monsieur Bodine would advise the anthropohippos to watch his opportunity and disable his rider by a well-aimed kick. Two gamekeepers of the Duke of Brunswick, both men of unimpeachable veracity, once saw a whole cavalcade of Walpurgis-riders, but hesitated to shoot for fear of hitting a hack instead of a hag. In the same duchy a witch *in tormentis* once revealed a sentence that would horsify a man in a minute, but Monsieur Bodine is happy to state that he has forgotten the formula. To remember such things is highly dangerous. One judge of the Criminal Court of Lorraine had cross-examined so many witches that he at last began to suspect himself, and, having dropped a hint to that effect, was seized and burned with the proper rites.

With the exception of Ibn Chaldir, who passed nine tenths of his long life in a public library, Robert Burton, the vicar of Segrave, was probably the best-read man who ever lived. He had studied philology, philosophy, theology, law, and medicine; he was a first-class mathematician, a zealous astronomer, and "calculator of nativities"; he had read nearly every volume in the Bodleian collection and in the library of Christ-Church College. He was well versed in the philosophical speculations of the mediæval school-men. He had mastered the inductive system of his great contemporary. All this learning did not prevent him from perpetrating the following dicta:

"The air is not so full of flies in summer as it is at all times of invisible devils. . . . Fiery devils are such as commonly work by blazing stars, fire-drakes, or *ignes-fatui* (which lead men often *in flumina aut præcipitia*), whom, if travelers wish to keep off, they must pronounce the name of God with a clear voice, or adore him with their faces in contact with the ground. . . . Aërial devils are such as keep quarters in the air, cause tempests, thunder and lightning, make it rain stones, wool, frogs, etc. . . . Subterranean devils are as common as the rest, and do as much harm. The last are conversant about the center of the earth, to torture the souls of damned men to the day of judgment; their egress and regress some suppose to be about Etna,

Lipari, Terra del Fuego (!), etc., because many shrieks and fearful cries are continually heard thereabouts, and familiar apparitions of dead men, ghosts, and goblins. . . . The devil being a slender and incomprehensible spirit, can easily insinuate himself into human bodies. A nun did eat lettuce without grace, or signing it with the sign of the cross, and was instantly possessed. . . . A young maid called Katherine Galter, a cooper's daughter, had such strange passions and convulsions that three men could sometimes not hold her; she purged a live eel, which suddenly vanished; she vomited *some twenty-four pounds of strange stuff of all colors, twice a day for fourteen days*, and after that she voided great balls of hair, pieces of wood, pigeon's dung, parchment, goose-dung, coals, and large stones. They could do no good on her with physic, and left her to the clergy. . . . The arts of witches are almost as infinite as the devil's, who is still ready to grant their desires, to oblige them the more unto him. They can cause tempests and storms, which is familiarly practiced by witches in Norway and Iceland, as I have proved (!). They can make friends enemies, and enemies friends by philters, *turpes amores conciliare*, enforce love, tell any man where his friends are, about what employed, though in the most remote places, and, if they will, bring their sweethearts to them by night, upon a goat's back flying in the air."—("Anatomy of Melancholy," Part I, section 2, subject i–iii.)

Neither learning nor logic afforded a safeguard against the monomania of the middle ages, and Northern Europe owed its final deliverance to the love of freedom rather than the love of science. The delusion of the fourteen hundred years' interregnum of reason was to all purposes a contagious mental disease; and who shall say if the prophylactics of our present civilization afford a guarantee against the recurrence of such epidemics? In the mind of a mental pathologist the progress of spiritualism, with its revived thirst for miracles, might awaken unpleasant recollections of the second century—the eve of the era when St. Gregory Thaumaturgus carried the day against the protests of the Roman Huxleys and Carpenters. The trouble is, that the creed of science has thus far been always agnostic, and its negative propaganda could not maintain the field against the enthusiasm of a positive superstition. Faith strikes deeper roots than skepticism, and the dogmas that could crush out the logic of Aristotle found their match in some of the silliest myths of paganism. Several myths of this sort proved so wholly ineradicable that the new creed could assert its supremacy only by a kind of grafting process, a mythical metastasis that enabled the new dogma to draw its nourishment from the root of an old superstition. The period of many Catholic festivals coincides with the season of ancient Roman and Druidical mysteries. Sacred fanes became miraculous shrines; Ceres, Bacchus, Venus, Pan, and Priapus still collect their old perquisites in the name of new saints.

Even popular traditions have thus been metamorphosed. In the mystic recluse of the Barbarossa legend, Professor Grimm recognized the All-father Wodan, whose attributes had been transferred to the person of Charlemagne, and afterward to Frederick Barbarossa. When the oaks of the sacred groves were felled for church-timber, the old Saxon god retired to the mountains, the usual refuge of exiled deities, and finally went to sleep in a mountain-cave, the Untersberg, near Salzburg, and the Kyfhäuser in Northern Germany, where he awaits the return of better times, the resurrection of the buried nature-worship and the departure of the black crows, the clerical birds of ill-omen that fly croaking around his rocky retreat. The prototypes of these croakers did not relish the legend, and managed to substitute a secular hero, and in another case even a spook. The Wild Huntsman was originally a Welt-jäger, a *world-hunter*, the old sport-loving wood-god, with his hounds and falcons and train of merry companions. In Western Pomerania the leader of the nocturnal chase appears under the semi-*incognito* of a Junker *Hakelberg*, the "cowl-bearer"—another cognomen of the mist-shrouded Odin.

Sir William Jones's researches into the sacred writings of Brahmanism revealed a still stranger metempsychosis of myths—the transfer of the primeval Krishna legend to the personal history of Buddha Sakya-Muni, and its subsequent exportation to a far Western colony of Buddhism. According to Maurice's translation of the Bhagavat Purana, Krishna (like Buddha) was a Parthenogenitus, a virgin-son. The birth of both Krishna and Buddha was foretold by a heavenly messenger. Both were of royal descent. The delivery of the virgin-mothers was attended by the same prodigies, the rising of a new star and the appearance of a company of heavenly choristers. Three Eastern monarchs visited the new-born infant. Cansa, the ruler of Krishna's birth-land, ordered a massacre of young children in order to prevent the fulfillment of an ominous prophecy. Both Krishna and Buddha passed several years in exile before they entered upon their mission of reform. Krishna, like Buddha, had twelve favorite converts, who accompanied him on his missionary travels. *Cætera, qui nescit?*

Our very hobgoblins are of Eastern origin; nearly all international fairy-stories and popular traditions have their roots in the fruitful myth-garden of Hindostan. The stories of Cinderella, of Tamerlane, and Jack the Giant-killer, amused the children of Sind before Nimrod built his great adobe palace; William Tell learned his trade in the archer brigade of a Nepaulese tyrant; and the fair Melusina used to bathe in the Ganges before she built her swimming-hall in the castle of Poitiers.

Of the Melusina legend a modern French evolutionist (M. de Lescure) gives the following curious exegesis: "The discovery of the Marquis of Poitiers, which resulted in the dissolution of his connubial tie, may yet lead to other divorces if the allies of the orthodox cos-

mogony should take a peep through a certain key-hole. The allegory reveals the great *arcanum* of nature, the secret, namely, that the human shape divine has been evolved from the form of a fish."

[*To be concluded.*]

METHODS IN MODERN PHYSICAL ASTRONOMY.*

By M. JULES C. JANSSEN.

IT has become an almost consecrated custom for the President of this Association, instead of relating the progress which has been made in all the sciences that are the objects of your investigations, to treat more particularly of a single one of them, and to present a summary of the progress it has made. This custom appears an excellent one to me. By it we gain in precision and authority what we lose in extensiveness; and we owe to it many masterly efforts, the impression of which has not yet been effaced from our minds, and which cause in me a just apprehension that I may fall far short of their standard.

I shall endeavor to present to you a picture, sketched in broad outline, of the progress and influence of a branch of research which has played a considerable part in contemporary scientific movements, and the discoveries of which have not only revolutionized our astronomical knowledge, but have also opened new and unexpected horizons to philosophy—I mean physical astronomy.

Physical astronomy is a wholly modern—yes, as to its best parts, contemporary—science; and it can be regarded as old only as concerning its object. From the earliest times, in fact, that men began to look toward the sky, and the first reflections on nature were born of these first observations, man has asked what is that sun whose immense and beneficent function caused it to be designated at that early period as the soul of nature. He has asked himself what is the cause which lends to the moon the sweet and mysterious light that gives to the nights so poetical a charm; and afterward questions arose concerning those brilliant points with which the celestial vault is strewed. All these problems appertain to our science, but how little was man then in a condition to deal with them! Long ages of observations and labor were necessary before even the corner of the veil could be raised.

This was because physical astronomy presupposes a very clear knowledge of the properties of light, both as to itself and as to its relations with bodies, and great perfection in the mechanical arts to

* President's address at the French Association for the Advancement of Science, La Rochelle, August, 1882.

permit the construction of the apparatus, at once extensive and delicate, which it employs.

Astronomy as a description of motions, on the contrary, only required the eyes and very simple instruments. Therefore the first astronomers began with that branch. At a later period, the science, ceasing to be purely descriptive, became geometric, and at last took a sublime flight; and by the application of the higher calculus we had the celestial mechanics.

During this long period, the physical branch of the science, to speak correctly, did not exist. Reduced to hypotheses that could not be verified, the theories of celestial physics had even fallen into discredit. It should be said that the beauty and importance of the discoveries with which the geometricians endowed the elder sister of our branch contributed no little to this result. Three great discoveries have, however, completely changed the situation, by giving to the physical branch arms which permit it at last to enter gloriously into the competition. I refer to the telescope, spectrum analysis, and photography.

The foundations of physical astronomy were laid in the invention of the telescope. Every one has heard of the emotion which filled Europe at the announcement of the discovery of an instrument which had the power of making distant objects appear as if they were near. It was at that time that Galileo, having only learned that such an instrument existed, discovered its arrangement, constructed one, turned it toward the sky, and, with this aid, fertilized by his genius, made a series of magisterial discoveries. These discoveries belong pre-eminently to physical astronomy, and form its first courses. If we except the sun and moon, which have a very sensible diameter, and admit of some observations without the aid of the telescope, all the stars appear to the eye only as brilliant points, and admit of no studies except of their motions. Therefore, an astronomy without the telescope would never have permitted us otherwise than as a matter of probability to consider the planets as like the earth in form, constitution, and office. But when it was seen that these brilliant and almost blazing points were resolved under the telescope into well-defined disks, showing indications of continents, clouds, and atmospheres; when satellites were perceived around those globes playing the same part to them as the moon plays to the earth—then probabilities gave place to a clear certainty. Telescopes, then, are the instruments by means of which the constitution of the solar system has been definitively unveiled, and the earth has been assigned its part and its rank in the system of the planets. The discovery of the spots on the sun and of its rotation completed the conception of the solar system and prepared for the theory of its formation. Here is marked a well-determined phase in the history of human ideas respecting the universe, and it is characterized by the great name of Galileo.

Was it possible at once to go beyond this? Was it possible to question the stars in their turn, and inquire if, like the sun, they had a sensible disk, spots, a rotation, and planets revolving around them; was it possible, in short, to extend to the stellar universe the notions we had already acquired concerning the solar system? The methods in use did not yet permit this.

The most delicate measurement of parallaxes has proved that the star nearest to us is two hundred thousand times as far off as we are from the sun. We should, then, need a telescope magnifying more than two hundred thousand times to show us, under the most favorable circumstances, a star's diameter equal to that which the sun presents to the naked eye. Such a power is a hundred times greater than the strongest powers that can be used. We are, therefore, obliged to stay within the limits of our system, and proceed by analogy when we desire to go out of it. The analogies, it is true, were very powerful means even with Copernicus and Galileo, but with Kirchhoff and Huggins they were destined to acquire very shortly an irresistible force. Nature habitually reserves for the assiduous and sagacious observer surprises that exceed his hopes. So, while the study of the stars, considered as individual worlds, still remained beyond our reach, a great observer discovered facts of a very general bearing.

This leads us to a second phase of the period of telescopes—a phase that was characterized by the observations of the great Herschel. Herschel changed the form of the instrument, and adopted one that was more adaptable to the realization of the great powers he sought to obtain. Then, by his magnificent studies of the nebulæ, and by his discovery of multiple stars revolving around one another, he laid the foundations of the theory of worlds with multiple centers. This was a new conception, which did not proceed from that of the solar system, but was much more general. The problem was thus resolved in its extreme terms; but between these extremes yawned an immense gap.

The gap has not yet been filled. We can not directly study those worlds which each star forms with the planets of its suite, but a new method of investigation has come forward to shed unexpected light on the unanswered questions.

The first period of physical astronomy was opened with the modest telescope of Galileo, and closed with the large telescopes of Herschel. As early as the beginning of this century, when the astronomer of Slough had finished his review of the sky, it was felt that the telescopic harvest was nearly gathered, and another instrument of progress was looked for. Arago thought he had found it in the discovery of Malus, to which he made brilliant additions, and earnestly endeavored to found a new branch of physical astronomy on polarization. He was not successful. His discoveries ceased after a few beautiful applications of his method. At this time the polariscope process is only employed to determine whether light is reflected or emitted.

Quite different was it with a method the origin of which, we believe, goes back to the very birth of optics. This method is likewise founded on the actions of bodies on light, but, so rich and profound are the modifications with which it has to deal, that it has been able to pass over that in the matter which concerns only its general properties, and look into its peculiar individuality, its specific chemical quality. The principle which is the basis of the new method of spectrum analysis is as simple as general, and may be stated by saying that the elementary rays emitted by every kind of radiating gasiform matter depend upon and characterize the chemical species to which that matter belongs. Hence it follows that the spectral image resulting from the analysis of the beam of rays emitted by any body will vary according to the chemical nature of that body. Spectum analysis is founded upon the examination of spectra.

It must be added that the chemical nature of a body is not the exclusive element in the constitution of its spectrum, but that that may vary with the physical circumstances of the phenomenon, the temperature, the cause generating the radiation, etc.; but these are subordinate effects, which only add to the richness of the method, without detracting from its certainty and its value.

We have been able to leap over the enormous distance which separates the conception of the body, viewed as to its general properties, from the notion of it as individualized in such a manner as to constitute a chemical species by regarding light not only as a whole, but also in its elementary parts; by not only studying the whole beam and the general modifications that affect it, but by extending the examination to the elementary rays of which it is composed. The little mass of matter forming the chemical molecule, when it can vibrate freely, as in the gaseous state, emits a peculiar system of waves, a system which varies principally with the chemical species of the molecule, but which varies also, though rather secondarily, with the distance apart of the molecules and the nature and intensity of the forces that induce a vibratory movement in it. We might illustrate the nature of the system of luminous rays emitted by such a molecule by comparing it to the system of sounds given off by a vibrating cord, which is dependent for the principal characteristic on the length of the cord, and for the secondary phenomena of volume, tone, etc., on other circumstances accompanying the vibration.

It is proper to remark at this point that, when we analyze light in this way to examine it in its elements, we perform an operation entirely parallel to that of the chemist who separates the simple elements of a compound body. The elementary ray is a chemical species in light. It has all the characteristics of a species. It is incapable of decomposition, it has an individuality of its own, characterized by its wavelength, by the physiological effects it induces, whether acting alone or in association with other rays, and by the phenomena which it exhibits

in its relations with bodies. We then bring the two sciences together by performing on light an operation parallel to the one that has been made on matter. Chemical analysis by light was performed *in posse* on the day when its rays were regarded in the light of chemical species.

This great idea of the specific character of luminous rays is due to Newton. It was introduced into science when that great genius gave his explanation of the action of the prism on white light. The foundations of spectrum analysis were laid at that time, and the study of it might have been begun then at once; but the human mind does not proceed with so penetrating and absolute a logic as that. The successive and often fortuitous acquisition of revealing facts had to be left to time. It must, however, be said that, when the facts were presented, their real significance would have been overlooked, notwithstanding the genius of the experimenters, had not the grand idea of Newton illuminated them with its brilliant light. The conception of the individuality of the rays made its way so slowly into our minds that it bore its fruits, as it were, unknown to us. But history, whose vision goes back to the beginnings, will have to assign their respective parts to the causes which have been influential toward the end. The allotment will in no degree diminish the admiration which is due to the creators of the marvelous instrument. They have given a body of life to what was slumbering *in posse;* they have thus shown themselves worthy continuers of the work of Newton.

You know that this spectrum analysis made its appearance very suddenly in science. You may recollect the emotion that affected us all when it was announced that the solar atmosphere had been chemically analyzed, and a list of the metals it contained was published. You are, however, too well acquainted with the history of science to suppose that a method as complete as the one that was thus announced had no antecedents. The antecedents in fact existed, and they were even numerous. With the labors which contributed to the constitution of the definitive method were associated the names of Sir John Herschel, Talbot, Miller, Wheatstone, Swan, Masson, Foucault, etc.; but Kirchhoff and Bunsen were able to make a synthesis of all these efforts, and they gave the method its general and practical form. When spectrum analysis presented itself to the scientific world, it held in one hand cæsium and rubidium and in the other hand a list of the metals recognized in a star ninety-three million miles away. Why, then, should we be surprised at the enthusiastic reception that was given it?

At first it was believed that the incandescence of gases was one of the conditions of elective absorption by them. A French physicist, judging that the phenomenon related rather to the gaseous condition than to the temperature, was led to believe that the earth's atmosphere, as well as the atmosphere which was supposed to exist around

the sun, might exercise such an action; and he showed that the solar spectrum contained a whole system of dark and fine lines, comparable to the lines of solar origin, but which were due to the action of our atmosphere. Brewster had already discovered that the solar spectrum was enriched with dark bands at sunrise and sunset, but that in his instrument they wholly disappeared during the day. Both Brewster and Gladstone, his eminent co-laborer, declared in their last memoir on this subject, in 1860, that they could not determine the cause of the phenomenon.

The absorbing action of our atmosphere was still more plainly demonstrated by an experiment on the Lake of Geneva, in which the absorption rays were obtained with the light of a fire passing over Lake Leman, from a distance of fourteen miles. It was also shown in an experiment made at Villette, with a tube filled with vapor at seven atmospheres of pressure and one hundred and twenty feet long, that the vapor of water has a complete absorption spectrum, and that the largest proportion of the absorption phenomena of our atmosphere should be attributed to it.

These observations and experiments doubled the field of investigation opened to spectrum analysis. Not only could the incandescent atmospheres of the sun and the stars now be made to reveal their nature and their composition to us, but our researches might also be extended to objects having a still greater interest for us. We could at once take our own atmosphere for an object, investigating high and inaccessible regions, and making analyses in them which could not be attempted by any other means. Then, going away from the earth, we could interrogate the planetary atmospheres, and seek in them the vapor of water, and with it one of the first conditions of the development of terrestrial life. We could also, comparing the composition of the planetary atmospheres with the astronomical facts which permit us to judge of the geological conditions of the surfaces of the planets, follow in them the atmospheric evolutions which on the earth belong to the domain of the past or of the future. Finally, the same study of the planetary atmospheres, when it shall have become more complete, will show us whether our atmosphere is a type reproduced everywhere, the composition of which appears from that fact indispensable to the existence of living beings, or whether, discovering atmospheres of varied compositions, we shall be led to suppose that life may appear and be developed in media essentially different. The planetary stars are not, however, the only ones that lend themselves to these applications. There are also fixed stars the spectra of which reveal the characteristics of the vapor of water. Now, we know that the atmosphere of a star must be considerably cooled to permit the gases of which water is constituted to combine and generate a vapor. Our sun is still very far from this critical condition. It is also remarkable that the stars presenting these characteristics are generally red or

yellow ones. In this manner the spectroscope may help us to estimate in some degree the age of a sun, and measure the length of the career which it has already accomplished.

While studies of this kind were going on in France, spectrum analysis was receiving magnificent developments in England, more in the line which its authors had indicated. Messrs. Miller and Huggins entered upon the study of the stars, and found in all of them which they examined the solar elements in various combinations. This discovery had an immense philosophical bearing, for it proved that the matter forming the solar and the stellar world is obtained from the same elements. It was a demonstration of the material unity of the universe. The study was prosecuted still further. There are stars which we regard as situated on the confines of the visible universe, the light of which is so weakened by the immense journey it has to make to reach us that they appear only as feeble glows. Mr. Huggins succeeded in analyzing some of them, and showed that there exists a whole class of nebulæ which are really unresolvable into stars, and are formed of incandescent gases, among which hydrogen, which thus seems to be the principal element in the composition of the universe, is the most prominent.

So the whole visible universe—not only our central star and the planets of our family, but those stars, too, which are so far off that our most powerful telescopes can not give them a sensible diameter, and those nebulæ which only make a weak glow in our instruments—is reached by our chemistry, seized by our analysis, and made to furnish the proof that all matter is one, and that these stars are made of the same stuff as we. More, still, than this: at those great distances, and in the presence of the vague and indefinite forms of the nebulæ, it would not be possible to study precise movements and discover whether the great law of gravitation reigns in such remote regions. Chemistry here comes to the aid of mechanics, and we may say boldly that that matter, which is identical with ours, is subject, like it, to the laws of gravitation. Certainly, when Newton decomposed a beam of white light, and laid the first basis of the theory of the spectrum, he had not the slightest suspicion that his law of gravitation would, at a later period, find in it wings to carry it into regions where all measurement ceases and all calculation is powerless.

Spectrum analysis, after having in this manner, in a few years, gone through the universe and reaped the magnificent harvest I have just described, now returns to the sun, the point whence it departed, to take advantage of the opportunity afforded by eclipses. These phenomena, it is well known, exhibit a collection of magnificent spectacles of an extraordinary character, which had heretofore remained unexplained. Those rosy-colored protuberances of strange forms which surround the dark limb of the moon, that magnificent luminous corona, those radiances in the form of a glory and extending to enormous dis-

tances—all constituted so many riddles for astronomers till 1868. In that year one of the great eclipses of the sun took place. We might say that, at the very moment when the heavens had just suffered their most precious secrets to be revealed, the star of day had deigned to invite us to the study of his admirable structure.

The eclipse was observed, and the result surpassed even the general expectation. The nature of the protuberances was immediately recognized, and a method was discovered that permitted the study of these phenomena every day, without having to wait for the rare occasions of eclipses. This method led in a short time to the discovery of the chromospheric atmosphere, and this completed and explained the phenomena of the protuberances. The first results of the spectroscopic investigations may be stated thus :

The sun of Herschel and Arago, formed of a central nucleus and a luminous envelope, the photosphere, has an additional stratum formed chiefly of incandescent hydrogen. This stratum, in immediate contact with the photosphere, is very thin, being only from eight to ten seconds thick ; it is the seat of small eruptions of metallic vapors rising from the photosphere, in which sodium, magnesium, and calcium predominate. Frequently, however, principally at the time when the sun-spots become abundant, there rise from the solar globe formidable eruptions of hydrogen, which pass through this same envelope and rise to a height of sixty thousand or ninety thousand miles. These eruptions are the protuberances of the total eclipses, the nature of which is thus revealed and the forms explained.

The corona and the phenomena exterior to it were the objects of study in the next eclipses. In 1874 French observations showed that the corona constituted a new solar atmosphere, a very rare one and enormously extended, in which hydrogen still dominated, while it presented spectral conditions as yet unexplained. This atmosphere seemed to borrow a part of the appearances of the protuberance-eruptions which penetrate it and are extinguished in it. It also seemed probable, and that opinion was expressed by the author of these observations, that the figure of the corona would vary with the condition of external activity of the sun. At the times of the maximum of spots, when the protuberance-eruptions were in the highest activity, the coronal atmosphere would be intersected by numerous and rich jets which would increase its extent and density, and change its aspect. This opinion was confirmed by one of the observers of the last eclipse in Egypt.

I shall conclude this brief review of the methods of physical astronomy with a word upon an art which has recently brought a really wonderful aid to all our scientific studies—I mean photography. Considered in its old and primary object, the aim of photography is to fix the images of the *camera-obscura*. Its aim, however, and its means have been singularly extended. We have to consider here only

the aid and the applications which physical astronomy can expect from it.

The first application which was made of photography to the study of the sky was in France, whatever may be said about it. The first image of a fixed star upon the daguerrean plate was that of the sun, and it was taken by the authors of the admirable processes for measuring upon the earth the velocity of light—MM. Fizeau and Foucault. Shortly afterward, images of the moon were obtained in the United States. These labors were followed by others, of which the sun and the moon were also the objects. Beautiful proofs of lunar photographs have been taken by Mr. Warren de La Rue and Mr. Rutherfurd. Photographs of the sun are taken regularly in many observatories, as aids in the study of the spots and faculæ of that star. More recently, Mr. Rutherfurd and Mr. Gould have begun to make celestial maps, and photographs of the nebula in Orion have been obtained in New York (by Mr. Draper) and at Meudon.

These works are all very important; they bear upon the primary object of astronomical photography, that of obtaining durable and trustworthy images of the stars and the phenomena produced upon them, available for further studies and measurements. Hitherto, observers had only memory, a written description, or a drawing, to depend upon for the preservation of the recollection of a phenomenon. Photography substitutes for this the material image of the phenomenon itself. It is an admirable artifice, which in a certain manner prevents the extinction of the phenomenon and its passage to among the things that were, and keeps it always with us for examination or study. Important as these results may be, the latest labors of which photography has been the object, especially in what concerns the sun, have demonstrated that the method may be employed as a means of making discoveries in astronomy.

The large solar images which have been obtained in the latest years at Meudon have revealed phenomena of the surface of the sun which our largest observatory instruments could not have shown, and which open a new field of studies. By their aid we can at last distinguish the real form of those elements of the photosphere, respecting which so many different and contradictory assertions have been made. The elements in question are composed of a fluid substance readily obedient to the action of external forces. At points of relative calm, the matter of the photosphere assumes forms more or less approaching the spherical, and its aspect is that of a general granulation. Wherever, on the other hand, currents and more violent movements of the matter prevail, the granular elements are more or less drawn out, and present aspects suggesting the forms of grains of rice, willow-leaves, or veritable threads. The regions, however, where the photosphere is more agitated, are limited spots, and the granular form is generally observed in the intervals between them. The result of this peculiar

constitution is, that the surface of the sun presents the aspect of a net-work, the web of which is formed of strings of more or less regular grains, with here and there elongated bodies drawn out in all directions. An attentive study of these curious phenomena leads us to a very simple explanation of them.

The stratum of luminous matter to which the sun owes its power of radiation is, as we know, very thin. If this stratum was in a state of perfect equilibrium, the fluid matter of which it is constituted would form a continuous envelope around the nucleus of the sun; and the granular elements being confounded together, the solar surface would have everywhere a uniform brightness. But the ascending currents, of which the eruptions of metallic vapors and the hydrogen-protuberances are evidences, rupture the fluid stratum which is tending to form at a great number of points. It is then broken up and divided into more or less considerable fragments. Wherever the perturbing forces leave the elements of the photosphere in a state of relative repose, they take a more or less pronounced globular form. At those points, on the other hand, which are the seats of ascending currents, these elements give evidence in their aspect of the violence of the actions to which they are subjected. Hence the variable forms of the elements of the photosphere, concerning which there has been so much discussion. Hence, also, the explanation of that net-work-like structure of the solar surface which has been revealed by photography.

These images also show the enormous difference between the luminous power of the elements of the photosphere and that of the medium in which they float, which seems quite dark by the side of them. A result of this constitution is, that the radiating power of the sun will be affected according to the number and brightness of these elements. The spots, then, can no longer be regarded as the principal element in the variations of the solar radiation; a new factor, the action of which may be preponderant, must hereafter be added to them.

These photographs permit another study, which promises results of extreme importance—the study of the motions which the granular elements take on under the action of the forces that rumple the photosphere. For the study of these motions, successive images of the same point on the surface of the sun are taken at very brief intervals with the photographic revolver. A comparison of the images demonstrates that the matter of the photosphere is animated by movements of the violence of which our terrestrial phenomena can convey only a very feeble idea.

Following the example of spectrum analysis, photography is making a circuit of the heavens. The year 1881 witnessed the first taking of the photograph of a comet, with a considerable portion of its tail. This picture has revealed some curious particulars of structure and has permitted a number of photometric measurements, the most notable of which is one showing that the tail, notwithstanding the

brightness with which it appears to shine, is, at only a few degrees from the nucleus, two or three hundred times less luminous than the moon. There will doubtless be room enough to perfect these first efforts, for it will be of the highest importance to obtain by photography incontestable documents for the history of these stars, the nature of which still presents so many enigmas.

Equally interesting efforts have been made with respect to the nebulæ. Mr. Draper, in America, and the observatory at Meudon, have obtained photographs of the nebulæ in Orion. The nebulæ are of great importance in their bearing on the theory of the formation of stellar systems and the genesis of worlds. It would be immensely interesting to establish clearly the existence and the nature of changes going on in their structure, and good photographs of them would be valuable for this. They are, however, difficult subjects, on account of the extreme weakness of their light, the uncertainty of their outlines, and the variations of brightness in their different parts. Consequently, we are liable to have images of the same nebulæ, in no way comparable with each other, but varying according to the length of the exposure, the clearness of the sky, and the sensitiveness of the plate; and it becomes imperiously necessary to define the conditions under which the images are obtained.

The images of any object impressed by light upon the eye are fugacious, and can be of only a limited intensity. The images fixed upon the photographic plate are permanent, and can be made of an intensity that becomes cumulative with the duration of the exposure. The photographic retina may be expected, when the art has been perfected in the highest degree, to give us images corresponding with an extremely expanded range in the duration of the exposure. We now obtain photographic impressions of the sun in the one hundred thousandth part of a second, and can not yet guess what the final limit will be in the direction of brevity. On the other hand, the images of the comet required an hour, and that of the nebulæ in Orion more than three hours of luminous action. Thus the luminous action was more than five hundred million times as long in the last case as in the first. What phenomena can have wide enough ranges in brightness or obscurity to escape so admirable an elasticity?

The photographic plates, moreover, which are prepared now, are not only sensitive to all the elementary rays which excite the retina, but the power also extends into those ultra-violet regions and the opposite regions of dark heat in which the eye has no power.

The priceless advantages which photography offers for the prosecution of our experiments are, in short, the preservation of the images, the extension of sensibility, and the faculty of seizing phenomena of the most different degrees of illumination, including the extremely strong and the extremely weak.

The above is a very incomplete picture of what has been accom-

plished by physical astronomy. Is it not enough, however, to show that our branch of the science has already attained the height of its elder sister? Are not the two worthy of each other, and will they not be able to march hereafter at an equal pace to the conquest of the heavens? On one side we behold the calculus—that marvelous intellectual lever, putting the data of observation to work, and drawing from them magnificent and unexpected consequences. On the other side, that wonderful apparatus which analyzes light as if it were matter, which forces it to give images of near and distant objects alike, and, seizing the fugitive images, makes them fixed and durable.

Behold on one side, again, the mathematical genius that has created the analysis of the infinite, a genius of exactness and thoroughness, which is able to enter into all the elements of a question and disengage from the complication of data the ultimate consequences signified by them. On the other side, the genius of observation, which now watches phenomena with the innate and superior sense that enables it to discover their intimate relations, now questions Nature and carries on its experiments as the geometrician carries on his analysis when he wishes to prove or discover something, and now, illuminated by a sudden inspiration, makes at a stroke one of those approaches that open immense horizons.

On one side behold, finally, the heavens measured, the solar world placed in the balance, and its movements so well linked together by the law that governs them that soon, perhaps, past, present, and future will no longer exist for astronomy. On the other side, wonders still more astonishing: stars revealing to us their forms and the most minute details of their structure, as if they had left the depths of space to offer themselves submissively to our study; worlds intrusting the secrets of the matter that engenders them to the rays which they send us; and the history of the sky written by the sky itself. Finally, by the united efforts of the two, the entire universe, in its majesty and its grandeur, become the intellectual domain of man.

EVOLUTION OF THE STETHOSCOPE.

By SAMUEL WILKS, M. D., F. R. S.,
PHYSICIAN AND LECTURER ON MEDICINE, GUY'S HOSPITAL.

INSTEAD of placing on the table every imaginary form of stethoscope manufactured out of every possible material gathered from the shops of the instrument-makers, I will carry you back to the origin of the stethoscope, and you will see how, on the principle of selection and the survival of the fittest, the primitive instruments have departed from the scene and are now only to be found among the

fossilized curiosities, the relics of former ages, on the antiquated shelves of some very old medical practitioner. The stethoscope, as you know, was invented by Laennec. He relates how in the year 1816 he happened to recollect a well-known fact in acoustics of solid bodies conveying sound, and he goes on to say: "Immediately on this suggestion I rolled a quire of paper into a kind of cylinder and applied one end of it to the region of the heart and the other to my ear, and was not a little surprised and pleased to find that I could thereby perceive the action of the heart in a manner much more clear than by the application of the ear. . . . The first instrument which I used was a cylinder of paper formed of three quires completely rolled together and kept in shape by paste." Laennec then goes on to describe how he copied this roll of paper in wood, metals, glass, and other substances, and finally he says: "In consequence of these various experiments I now employ a cylinder of wood an inch and a half in diameter and a foot long, perforated longitudinally by a bore three lines wide and hollowed out into a funnel-shape to the depth of an inch and a half at one of its extremities. It is divided into two portions, partly for the convenience of carriage and partly to permit its being used of half the usual length. The instrument in this form—that is, with the funnel-shaped extremity—is used in exploring the respiration and rattle; when applied to the exploration of the heart and the voice, it is converted into a simple tube with thick sides, by inserting into its excavated extremity a stopper or plug traversed by a small aperture and accurately adjusted to the excavation. This instrument I have denominated the *stethoscope*."

Fig. 1 represents Laennec's roll of paper, and Figs. 2 and 3 the copy of this in wood as he describes. The latter figure is drawn from an instrument kindly given me by Dr. Galton, of Norwood, being the stethoscope long used by his father. It does not separate into two

Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5.

pieces, but contains the plug which can be removed so as to leave the end hollow. Fig. 4 is the same instrument with the sides cut out to make it lighter and more elegant, the ear-piece being the same as before, and the mouth also hollowed out. This was the stethoscope used and recommended by the late Dr. Hughes. By making the in-

strument still more elegant and slender we have the modern stethoscope in endless variety, as in Fig. 5. It is thus very evident how the modern instrument has been framed out of the original block of wood which was made the counterpart of Laennec's roll of paper.

I know not who invented the instruments with flexible tubes, but I have no doubt that a search into medical history could tell us. I remember, however, that the first flexible stethoscope which I ever saw was the one depicted in Fig. 6, and used by Dr. Golding Bird when he saw out-patients in the year 1843. Being much crippled with rheumatism, and therefore not wishing to rise from his chair, he found

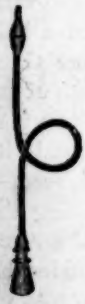

FIG. 6.

FIG. 7.

FIG. 8.

this instrument very convenient; he also was enabled to pass the ear-piece to gentlemen standing near him, while he held the cup on the part to be examined. I always thought it was his own invention. But, whether so or not, I do not think any great effort of genius was required to frame a flexible instrument, and then adapt it for the use of one or two ears. This being done, the next step would be to make two mouth-pieces to apply to the chest at different spots. Various modifications of these instruments have been made of late years, but the first notice of them I have any knowledge of in my reading is to be found in a letter to the "Lancet" of August 29, 1829, by Mr. Comins, of Edinburgh, headed "A Flexible Stethoscope." This was only twelve years after Laennec's invention. It is difficult from his description to picture the instrument, but it seems to have been composed of jointed tubes, and made for two ears as well as one. Mr. Comins expresses his surprise that the discoverer of mediate auscultation did not suggest a flexible instrument, as he says "it can be used in the highest ranks of society without offending fastidious delicacy."

A very interesting fact was first pointed out to me by Dr. Andrew Clark, with respect to a peculiarity of the binaural in the objective appreciation of sounds; that if each ear-piece be separately used, and

any sound be made near the mouth-piece, it is heard in the ear itself, but, if the two pieces are employed together, the sound is heard at the spot where it is produced. The fact is very interesting in a physiological point of view, and further corroborates the theory as to the value of a double set of senses, or, in a word, of the body being made up of two halves, for just as the two hands feeling different parts of an object gain an idea of extension, and the two eyes by obtaining different views of any substance get a knowledge of its solidity, so in the same way the two ears listening to the same sound more thoroughly appreciate its objectivity.

If you look at this series of drawings you may perceive but little resemblance between the first figure and the last, but take them one by one and you will see that the figures are really progressive. My story of development is not imaginary, but historical.—*Lancet.*

SOCIAL FORCES IN AMERICAN LIFE.*

By HERBERT SPENCER.

A FEW words may fitly be added respecting the causes of this over-activity in American life—causes which may be identified as having in recent times partially operated among ourselves, and as having wrought kindred, though less marked, effects. It is the more worth while to trace the genesis of this undue absorption of the energies in work, since it well serves to illustrate the general truth which should be ever present to all legislators and politicians, that the indirect and unforeseen results of any cause affecting a society are frequently, if not habitually, greater and more important than the direct and foreseen results.

This high pressure under which Americans exist, and which is most intense in places like Chicago, where the prosperity and rate of growth are greatest, is seen by many intelligent Americans themselves to be an indirect result of their free institutions and the absence of those class-distinctions and restraints existing in older communities. A society in which the man who dies a millionaire is so often one who commenced life in poverty, and in which (to paraphrase a French saying concerning the soldier) every news-boy carries a president's seal in his bag, is, by consequence, a society in which all are subject to a stress of competition for wealth and honor, greater than can exist in a society whose members are nearly all prevented from rising out of the ranks in which they were born, and have but remote possibilities of acquiring fortunes. In those European societies which have in great meas-

* Remarks appended to Spencer's address at the New York banquet, reprinted in the "Contemporary Review."

ure preserved their old types of structure (as in our own society up to the time when the great development of industrialism began to open ever-multiplying careers for the producing and distributing classes) there is so little chance of overcoming the obstacles to any great rise in position or possession, that nearly all have to be content with their places: entertaining little or no thought of bettering themselves. A manifest concomitant is that, fulfilling, with such efficiency as a moderate competition requires, the daily tasks of their respective situations, the majority become habituated to making the best of such pleasures as their lot affords, during whatever leisure they get. But it is otherwise where an immense growth of trade multiplies greatly the chances of success to the enterprising; and still more is it otherwise where class-restrictions are partially removed or wholly absent. Not only are more energy and thought put into the time daily occupied in work, but the leisure comes to be trenched upon, either literally by abridgment, or else by anxieties concerning business. Clearly, the larger the number who, under such conditions, acquire property, or achieve higher positions, or both, the sharper is the spur to the rest. A raised standard of activity establishes itself and goes on rising. Public applause given to the successful, becoming in communities thus circumstanced the most familiar kind of public applause, increases continually the stimulus to action. The struggle grows more and more strenuous, and there comes an increasing dread of failure—a dread of being "left," as the Americans say: a significant word, since it is suggestive of a race in which, the harder any one runs, the harder others have to run to keep up with him—a word suggestive of that breathless haste with which each passes from a success gained to the pursuit of a further success. And, on contrasting the English of today with the English of a century ago, we may see how, in a considerable measure, the like causes have entailed here kindred results.

Even those who are not directly spurred on by this intensified struggle for wealth and honor are indirectly spurred on by it. For one of its effects is to raise the standard of living, and eventually to increase the average rate of expenditure for all. Partly for personal enjoyment, but much more for the display which brings admiration, those who acquire fortunes distinguish themselves by luxurious habits. The more numerous they become, the keener becomes the competition for that kind of public attention given to those who make themselves conspicuous by great expenditure. The competition spreads downward step by step, until, to be "respectable," those having relatively small means feel obliged to spend more on houses, furniture, dress, and food, and are obliged to work the harder to get the requisite larger income. This process of causation is manifest enough among ourselves; and it is still more manifest in America, where the extravagance in style of living is greater than here.

Thus, though it seems beyond doubt that the removal of all polit-

ical and social barriers, and the giving to each man an unimpeded career, must be purely beneficial, yet there is, at first, a considerable set-off from the benefits. Among those who, in older communities, have by laborious lives gained distinction, some may be heard privately to confess that "the game is not worth the candle," and, when they hear of others who wish to tread in their steps, shake their heads and say, "If they only knew!" Without accepting in full so pessimistic an estimate of success, we must still say that very generally the cost of the candle deducts largely from the gain of the game. That which in these exceptional cases holds among ourselves holds more generally in America. An intensified life, which may be summed up as great labor, great profit, great expenditure, has for its concomitant a wear and tear which considerably diminishes in one direction the good gained in another. Added together, the daily strain through many hours and the anxieties occupying many other hours—the occupation of consciousness by feelings that are either indifferent or painful, leaving relatively little time for occupation of it by pleasurable feelings—tends to lower its level more than its level is raised by the gratifications of achievement and the accompanying benefits. So that it may, and in many cases does, result that diminished happiness goes along with increased prosperity. Unquestionably, as long as order is fairly maintained, that absence of political and social restraints which gives free scope to the struggles for profit and honor conduces greatly to material advance of the society—develops the industrial arts, extends and improves the business organizations, augments the wealth; but that it raises the value of individual life, as measured by the average state of its feeling, by no means follows. That it will do so eventually, is certain; but, that it does so now, seems, to say the least, very doubtful.

The truth is, that a society and its members act and react in such wise that while, on the one hand, the nature of the society is determined by the natures of its members, on the other hand, the activities of its members (and presently their natures) are re-determined by the needs of the society, as these alter: change in either entails change in the other. It is an obvious implication that, to a great extent, the life of a society so sways the wills of its members as to turn them to its ends. That which is manifest during the militant stage, when the social aggregate coerces its units into co-operation for defense, and sacrifices many of their lives for its corporate preservation, holds under another form during the industrial stage, as we at present know it. Though the co-operation of citizens is now voluntary instead of compulsory, yet the social forces impel them to achieve social ends while apparently achieving only their own ends. The man who, carrying out an invention, thinks only of private welfare to be thereby secured, is in far larger measure working for public welfare; instance the contrast between the fortune made by Watt and the wealth which the

steam-engine has given to mankind. He who utilizes a new material, improves a method of production, or introduces a better way of carrying on business, and does this for the purpose of distancing competitors, gains for himself little compared with that which he gains for the community by facilitating the lives of all. Either unknowingly or in spite of themselves, Nature leads men by purely personal motives to fulfill her ends: Nature being one of our expressions for the Ultimate Cause of things, and the end, remote when not proximate, being the highest form of human life.

Hence no argument, however cogent, can be expected to produce much effect: only here and there one may be influenced. As in an actively militant stage of society it is impossible to make many believe that there is any glory preferable to that of killing enemies; so, where rapid material growth is going on, and affords unlimited scope for the energies of all, little can be done by insisting that life has higher uses than work and accumulation. While among the most powerful of feelings continue to be the desire for public applause and dread of public censure—while the anxiety to achieve distinction, now by conquering enemies, now by beating competitors, continues predominant—while the fear of public reprobation affects men more than the fear of divine vengeance (as witness the long survival of dueling in Christian societies)—this excess of work which ambition prompts seems likely to continue with but small qualification. The eagerness for the honor accorded to success, first in war and then in commerce, has been indispensable as a means to peopling the earth with the higher types of man, and the subjugation of its surface and its forces to human use. Ambition may fitly come to bear a smaller ratio to other motives, when the working out of these needs is approaching completeness; and when also, by consequence, the scope for satisfying ambition is diminishing. Those who draw the obvious corollaries from the doctine of evolution—those who believe that the process of modification upon modification which has brought life to its present height must raise it still higher, will anticipate that "the last infirmity of noble minds" will in the distant future slowly decrease. As the sphere for achievement becomes smaller, the desire for applause will lose that predominance which it now has. A better ideal of life may simultaneously come to prevail. When there is fully recognized the truth that moral beauty is higher than intellectual power—when the wish to be admired is in large measure replaced by the wish to be loved—that strife for distinction which the present phase of civilization shows us will be greatly moderated. Along with other benefits may then come a rational proportioning of work and relaxation; and the relative claims of to-day and to-morrow may be properly balanced.

THE FORMATION OF LUNAR CRATERS.

M. JULES BERGERON says, in a paper communicated to the French Academy of Sciences, and republished in "La Nature": "I have noticed that when gases or vapors pass through a mass having the consistency of paste, they leave behind them funnel-shaped holes. Struck by the analogy which these holes present with the craters of the moon, I have endeavored to reproduce the phenomena on a larger scale. To simplify my experiments as much as possible, I used alloys, melting at relatively low temperatures, taking first Wood's alloy, of seven parts of bismuth, two of cadmium, two of tin, and two of lead, which melts at about 158° Fahr. Having introduced into the mass, melted in the salt-water bath, a current of warm air by means of a tin pipe, I allowed it to cool slowly while the inflation of warm air was still continued. The ebullition which took place reached all the parts—which were beginning to solidify and form a pellicle—over a considerable surface; and there was formed before me a large circle, around which the edges gradually rose under the continued inflation, till it began to assume the appearance of a crater. At the same time, the metallic mass becoming thicker as the cooling went on, while it was still blown out by the air, could no longer drive the solid particles away from itself, and rose above the crater in such a way as to form a cone, which grew visibly more prominent. The crater also became more hollow, with its inner walls more inclined than the outer walls, and I had before me a formation strikingly analogous to the craters of the moon. The same phenomena were observed, whatever alloy I employed.

"Similar processes have possibly taken place on the moon. Instead of gas, the reliefs may have been produced by the vapors, which rose freely from the body while it was in a fluid state; but the superficial part of the planet being cooled much more rapidly than the interior, the latter, still fluid, continued to emit vapors after the surface had become quite thick. The vapors found their way along the superficial envelope, and came out only at particular points, where, doubtless, the process of solidification was least nearly accomplished. The vapors may subsequently have been condensed, or absorbed, by the substances constituting the rock of the moon.

"As my first experiments were made in a capsule, the objection might be made that the circular form of the crater was produced under the influence of the shape of the walls of the vessel. To obviate such criticism, I employed a rectangular basin, in which I melted an alloy of four parts of lead, four of tin, and one of bismuth. The phenomena were produced as in the former case; but I found that the aspect of the mass after the formation of the crater varied accord-

ing to what metal was used. With Wood's alloy, which is very fusible, the projections that fell on the edge of the crater flowed away, and left no trace of their passage. With the second alloy the pro-

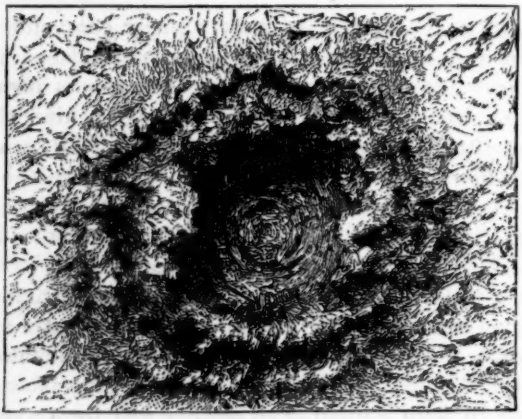

FIG. 1.—ARTIFICIAL CRATER OBTAINED WITH AN ALLOY.

jections all continued visible, and gave a rent aspect to the crater. Moreover, since the warm air was not hot enough to melt the metal, the projections might eventually overhang the bottom, as appears in Fig. 1.

FIG. 2.—ACTION OF A CURRENT OF AIR ON A MELTED ALLOY.

"The second experiment was marked by a very interesting incident. Two concentric circular areas were noticed, the one nearer to the center being the higher. This was due to an interruption to the

passage of the air during the formation of the crater. The edges of Copernicus, Archimedes, and several other lunar craters are marked by analogous features.

"A formation like a dike appears to rise in the center of a considerable number of craters on the moon. I have been able to produce something analogous to this also, a representation of which is visible in Fig. 2. After I had ceased blowing in air, a last bubble was formed, which uplifted the mass, but could not project it above the edge of the crater. The lunar dikes are very probably formed in this way, by the action of the gas, at the end of the active period of the craters."

SCIENCE IN THE SICK-ROOM.

By CLARA S. WEEKS.

THERE is no subject of so much general interest as this, concerning which there is, at the same time, such a widely prevalent ignorance. There are few, especially among women, upon whom will not devolve, at some time in their lives, the care of the sick; fewer still who will not at some time become dependent upon such care; and it might naturally be supposed that matters of such primary and universal importance as sanitary conditions and the practical application in the sick-room of scientific principles would be too familiar to every one to need to be further enlarged upon. But the fact is, it too frequently happens that all the scientific knowledge which ever enters the sick-room comes in with the doctor and goes out again with him.

This state of things requires to be improved. Knowledge, and that correct knowledge we call science, is just as indispensable to the nurse as to anybody else. It is a great mistake to suppose that all women—even all good women—make good nurses. The best intentions and the tenderest heart may coexist with an utter lack of executive ability, and be more than counterbalanced by ignorance and prejudice. Native aptitude gives advantage, but it can not be relied upon alone. Even those who possess in the highest degree the natural gift of ministration which renders them so acceptable to the invalid would find their power of usefulness very largely increased by a familiarity with what may be properly called the science of the sick-room. Physicians are recognizing more and more the importance of hygienic agencies in the treatment of disease, and with this there has come an increasingly urgent call for the scientific instruction and practical training of those who are to take charge of invalids. Science explains the conditions upon which the art of the nurse depends, and lays down principles which can not be violated without injury; but it is not at all necessary to make a parade of technical language in stating its re-

quirements. It is the object of the present article to furnish a few simple directions for the care of the sick that have the warrant of practical experience.

The first thing to be considered is the room itself. And the proper time to consider it is when you build your house. But, as most of us are forced to be content with houses already built, and built with no reference in the mind of the architect to the probability of illness among its inhabitants, it is only left for us to see how we may best avail ourselves of such conveniences—or inconveniences—as we may chance to have. There is always, at least, a choice of evils.

The sick-room should be on the sunny side of the house, and have plenty of windows. Only in exceptional cases, such as inflammation of the eye or brain, is it necessary to have the room darkened, and even then a south room, with the light carefully moderated by blinds and curtains, is to be preferred to a darker one on the north side. In the majority of cases, light, and not only light, but direct sunshine, is to be desired, not only for the additional cheerfulness which it gives, but because of its actual physical effects. Sunlight is a powerful remedial agent. You put the drooping plants which you wish to restore to vigor in the brightest, sunniest spot in your house—do the same with the feeble and sickly human being for whose improvement you are so anxiously looking, and you will derive similar beneficial results.

The sick-room should be, as far as possible, remote from the noises of the house and of the street. If, as is sometimes the case, this desideratum is quite incompatible with the last-named, still, except where there is great nervous irritability, give the preference to the sunny side, even at some loss of quiet.

Noise which is understood and inevitable is far less annoying than would be a much slighter noise, unexplained or unnecessary. Intermittent is more hurtful than continuous noise. Sudden, sharp, and jarring sounds are especially to be avoided. Manage, if possible, to have the room over your patient unoccupied. Modern houses are so slightly built, and their vibrations so trying, that, unless you can so arrange, you will often find it better to put your patient at the top of the house, in spite of the fatigue of the stairs.

Many slight and apparently unimportant noises, which are nevertheless peculiarly annoying to the sensitive nerves of the sick, may easily, with a little care and forethought, be entirely done away with. If you have coal to put on the fire, bring it in wrapped in a paper, and lay it on paper and all. Oil the hinges of creaking doors. Fix wedges in rattling windows. Keep rocking-chairs out of the room. Avoid wearing clothes that rustle or shoes that squeak. Do not whisper, either in your patient's room, or just outside his door. A low, distinct tone, when conversation is necessary, will seldom annoy. Whispering always will, as will any sound which creates strained at-

tention or a sense of expectation. If you have anything to say which you do not wish your patient to hear, say it somewhere else than in his presence.

The first and greatest requisite in a sick-room is purity of air. This is only to be attained by constant and thorough ventilation. Ventilation is the displacement of impure by pure air. To secure this, there should be two apertures to the room, one for the egress of the foul air, and one for the admission of fresh air. The best possible arrangement is that of an open window and an open fire-place. If you do not wish a constant fire, keep a lamp burning at the mouth of the chimney to create a draught. Arrange a blind or screen so that the air will not blow directly upon your patient, and you may keep the window open day and night without danger of chilling him. Do not make the common mistake of confounding cold air with pure air. You may keep the room at any desired temperature, and still have the atmosphere perfectly fresh; or you may lower the temperature to any extent without removing a particle of the poisonous impurities with which the air is laden. Keep your patient as warm by means of external appliances as his comfort demands, but never shut out the fresh air. Fresh air can only come from outside the house. Opening a door into a passage or an adjoining room, itself imperfectly aired, is not ventilation. Fresh air, may, however, be admitted to the sick-room through an adjoining apartment, first thoroughly ventilated. This is sometimes the best method of procedure. It requires, of course, more care to keep a small room well aired without objectionable draughts than a large one.

Stationary basins should never be used in the sick-room. The perfect system of house-drainage has yet to be invented, and the danger from leaky and defective traps is so great that the only safe way is to avoid them altogether. If you have such arrangements in the room which you propose to devote to your invalid, cork up the overflow-holes—or, better, stop them with plaster-of-Paris—and fill the basin with water, which must be changed from time to time, or cover it entirely with a board. The increased healthfulness of the atmosphere will more than compensate for the extra trouble which will be occasioned by adherence to this precautionary measure.

No cooking should ever be done in the sick-room. Neither should damp towels or articles of clothing be aired and dried there. All excreta should be promptly removed. Upon attention to these details depends that which should be the first care of every person in charge of the sick—that the air they breathe should be as pure as that outside.

The room, then, which we select for our invalid should be sunny, quiet, the one which affords the best facilities for ventilation and warmth, and without sewerage.

In the arrangement of the room, the same regard for the comfort and welfare of its occupant should be maintained.

The bed should be in the lightest part of the room, far enough removed from the wall to allow a free circulation of air around it, and to be easily accessible from both sides. It should be so situated that the patient can see out of the window. If you can give him a view from two windows, so much the better. Few people who have not experienced it can realize the weariness of mind which arises from long confinement to one set of surroundings. You have but to spend a few days in one room to become painfully familiar with every petty detail of its furnishing, and such variety as may be obtained from a glimpse out-of-doors will often afford an infinite relief.

It is frequently recommended that all superfluous and merely ornamental articles be removed from the sick-room, as useless incumbrances, only affording so many additional lodging-places for dust; but, unless you are dealing with contagious disease, you will find it better to spend a little more time in the removal of dust than to leave the sufferer with only the bare walls to gaze at, and nothing visible to vary the monotony of his thoughts. That a carpet or wall-paper of set pattern, or anything else presenting regularly recurrent figures, is objectionable, does not need to be suggested to any one who has ever been beset by the counting and classifying fiend who so often takes possession of the invalid left with no occupation for his vacant mind beyond such as is suggested by the objects within his limited field of vision.

Let the room be as cheerful as possible in its aspect. Flowers are quite permissible. Growing plants are better than cut flowers. The latter must be removed as soon as they cease to be perfectly fresh.

There should be no medicine-bottles or medical appurtenances of any kind in sight. They belong in the closet, and should be kept there, except when in actual use.

A thermometer is indispensable. Never permit yourself to judge the temperature of the room by your own sensations or by those of your patient. Hang the thermometer as nearly as possible in the center of the room—at all events, neither against a chimney in use or the outer wall. The one will be hotter and the other colder than the mean temperature, which is what you wish to have registered. This should be, unless you have contrary orders from the physician, about 68° Fahr.

The necessity for absolute cleanliness can not be too strenuously insisted upon. Dusting can only be efficiently done with a damp cloth. The ordinary methods in vogue simply serve to transfer the dust from one spot to another. Removal, not distribution, should be the object in view. The room can only be thoroughly swept and cleaned when the patient can be moved out of it for a time; but the dust may be removed from the carpet quite effectively and noiselessly by means of a damp cloth wrapped around a broom.

Not only for the sake of appearances, but from more directly hygienic considerations, are cleanliness and order to be regarded.

Upon the proper arrangement and care of the bed will largely depend your patient's comfort. This should be low and narrow enough for you easily to reach him from either side. The bedstead should be of iron or brass, with springs of woven wire, permeable by the air in every part. This is the only kind which you can be sure of keeping thoroughly clean. On this should be a hair mattress, never a feather bed. Make the under sheet as tight and smooth as possible, and take especial pains to keep it thoroughly dry and free from wrinkles, crumbs, and other inequalities. Neglect in this particular will give rise always to much discomfort and sometimes to serious troubles in the form of pressure-sores—which are extremely difficult to cure, but nearly always preventable by care. Very heavy or very much emaciated patients, and those suffering from affections of the brain, are particularly liable to these. It is often advisable, especially where a bed is prepared for long occupancy, to put next to the under sheet one of rubber, covered with a second folded sheet, or draw-sheet. This can be easily and frequently changed with but very slight disturbance to the patient. The bed-coverings should be such as are warm without being heavy, as their weight is often found oppressive. In some cases even slight pressure is unendurable. The weight of the clothes may then be supported by a wooden frame-work underneath.

All bedding should be frequently renewed, and always well aired and warmed before being used. If you have a patient entirely confined to bed, it will add greatly to his comfort if you can give him two beds, each provided with its own complement of sheets, blankets, etc. Let him occupy one during the day, and be transferred to the other for the night. If they are of equal height, this can be easily done, and the smooth, fresh condition of the unused bed will do more than any narcotic toward securing for him a good night's rest.

To prop a patient up with pillows, begin by slipping one as far down as possible against the small of the back. Put the next and succeeding ones each behind the last; this will prevent them from slipping. Aim to raise the head, and support the shoulders without throwing them forward so as to interfere with the free play of the lungs. Two or three small pillows, which can be moved from place to place as occasion requires, will be found of great service.

About the person of your patient, no less than about his room, labor to secure the most scrupulous cleanliness. Neglect of this too often arises from a fear that the patient will take cold; but it entails a greater risk than this to leave him in clothing saturated with morbid effluvia, and with the pores of his skin clogged by the noxious products of disease. No patient is ever too ill to be kept clean. If proper precautions are used and unnecessary exposure avoided, no danger need be apprehended.

The proper administration of food is often the great problem of the sick-room. There must be due regard to the kind, quality, and

quantity, and to the time and manner of giving it. The kind of food to be given is usually prescribed by the physician. If it is left to your own discretion, consult, as far as possible, the tastes of your patient, try to secure a judicious variety, and do not let him know until you bring it what he is going to have next. Milk is the only article of diet which contains in itself all the essential elements of nutrition. It is, therefore, the only thing upon which you may allow your patient entirely to subsist for any length of time. The most concentrated forms of food are to be preferred, such as convey the greatest amount of nourishment in the smallest bulk.

Whatever you give, be sure that it is the best of its kind—milk perfectly sweet, eggs above suspicion. Remember that you have more than the ordinary fastidiousness to contend with, and never offer a sick person anything which you have not previously tasted yourself, and so feel absolutely sure of. This does *not* mean that you are to taste it in his presence. Bring only so much as can be taken at once. A large amount looks so discouraging that it destroys the appetite for even a little. Take away promptly what is not eaten. It is worse than useless to leave it in sight in the hope that it will soon be wanted. Give only a small quantity of food at a time, but give it at short and *regular* intervals. A cupful every two hours is more easily managed by weak digestive organs than would be a large meal three times a day. When a table-spoonful can not be taken hourly without distress, you may give successfully a tea-spoonful every quarter of an hour. The idiosyncrasies of each individual case must be considered. Regularity is, however, always important. When you do not feed your patient again until morning, it is well to give him some light and easily assimilated nourishment the last thing at night.

If you have a helpless patient to feed, do it slowly, and avoid unmanageable quantities. It requires attention and care to do this well without making an external application of it. Fluid food is most easily given, and with the least exertion on the part of the patient, through a bent glass tube.

Serve the food in as attractive a form as possible. If it pleases the eye, it has a much better chance of proving acceptable to a delicate appetite. You can at least have the dishes spotlessly clean, and dry on the outside. Have hot things hot, and cold ones very cold. To successfully cater to the capricious appetite of an invalid requires the faculty of observation, judgment, and no little ingenuity; but it is worth the exercise of them all, for in most cases the question of nourishment is more important than that of medicine.

Give medicine or stimulant ordered always on time, and measure it accurately. Acquire the habit of always reading the label before you open a bottle. Pour the contents from the unlabeled side. Cork tightly after using, as many drugs lose their virtue upon exposure to the air. Use no remedies, however beneficial you may fancy they

would be, without the approval of the physician in attendance. You may otherwise most disastrously conflict with his plan of treatment.

The patient himself should have no responsibility about the taking of medicine, the preparation of food, or anything else which can be spared him. In all small matters, relieve him entirely of the onus of decision. If there is any doubt in your own mind as to the expediency of this or that measure, do not let him share it. Let him feel that you know, and can be relied upon to do, what is best for him, without any necessity for thought on his part.

Perfect freedom from anxiety and cheerful surroundings are as essential for his mental, as are free ventilation, absolute cleanliness, and nourishing food for his physical, well-being. These are the elements of good nursing, and surely they are within the reach of all. Secure these, and you will have given the sick person under your care the best possible chance for recovery; at least you will ameliorate his sufferings, and relieve him from many an unnecessary aggravation.

THE DECREASE OF GOLD.

By F. von BRIESEN.

WHEN, in the beginning of 1850, California and Australia sent annually about one hundred and eighty million dollars of gold into the world, national economists became frightened, and Michel Chevalier and Cobden expressed the fear that the world would be completely inundated with a flood of gold. But when, after the year 1867, this production decreased with alarming rapidity, the opposite fears were expressed. As early as 1869, the London "Economist," when reviewing the year past, said that it would be a great blessing if new sources of gold could be discovered, since the production of thirty thousand pounds sterling per year was barely sufficient to cover the necessities of a flourishing commerce, more especially since America consumed a great part of the gold for itself, thus withdrawing it from the European market. Notable statesmen saw in it the cause of the periodically recurring commercial crises; and Professor Süss, of Vienna, demonstrated in his pamphlet, "The Future of Gold," that the present sources of gold are being exhausted, and that the territory in which new deposits might be found is gradually diminishing in extent.

It is not our purpose, however, to dissuss the national, economical side of the question, but merely to consider it in its scientific bearing.

Gold and silver are the so-called precious metals, for the simple reason that they are rare. But, if we ask why gold is so scarce, Dr. Süss answers that its scarcity is caused by its specific gravity.

We possess three metals distinguished for their great density—iridium, platinum, and gold. If we assume the weight of water as unity, the gravity of these metals is—iridium, 22·23; platinum, 21·50; gold, 19·25. With the exception of iridium, rare as well as remarkable, gold and platinum weigh more than any other metal: for instance, lead has a specific gravity of 11·35; silver, 10·47; copper, 8·80; and iron, only 7·84. The question occurs next, whether the scarcity of gold stands in any connection with its gravity.

Since the earth originally passed from a gaseous into a fluid state, the heaviest components must, in its fluid condition, have tended toward the center. If it be true that our entire planetary system developed from an immense nebula, it follows that the planets nearest to the center must be the heaviest.

"Their great specific gravity," says Professor Petzholt, speaking of metals, "is the reason that they can so rarely be seen on the surface of the earth; the largest masses are to be found within the interior, in a molten condition, and are there protected against the cupidity of man."

Further observations have confirmed the truth of this view. Because spectral analysis reveals no gold in the sun, we must accept the fact that it lies hidden in its interior, and that it is covered by lighter bodies, which, in a gaseous state, form the photosphere of the sun. Hydrogen, the lightest of all gases, constitutes the chief component of this photosphere. Now, the planets are divided into two groups, according to their weight: the heavy, which lie within, and the light, which lie beyond, the circle of the asteroids. Mercury, the nearest to the sun, is seven times as heavy as water; Venus, the Earth, and Mars are five times as heavy; while Jupiter barely attains the weight of water. The specific weight of Saturn is 0·73; of Uranus, 0·84; consequently, they are lighter than water. The density of Neptune, not yet exactly determined, is at any rate very small. We therefore find in our planetary system that the densest bodies are nearest to the center, and this leads us to the presumption that the same law governs on each individual planet, and that, therefore, the heavy gold must be found nearest to the center.

This leads to the question, Whence the gold and platinum to be found upon the surface of the earth? These two heavy metals are only found in places where volcanic rocks have penetrated through earlier formations, and the granite has split up. Platinum, only found in excess in the Ural Mountains, is obtained from rocks that have come up from below; gold is found only in quartz-veins. These veins have been formed in the following manner: As a natural consequence of the contraction of the earth's crust, internal revolutions, and volcanic eruptions, crevices opened, which were partly filled by hot springs, partly by eruptions with quartz. Rich deposits are often found in these crevices, called by the American miners "pockets," or "bonan-

zas"; but, besides these bonanzas, crevices contain no gold, and only the hope of encountering them leads to their being worked.

The places in which gold is found may be divided into the following three classes—auriferous ore, auriferous veins, and auriferous alluvium:

The first group contains ore, rich in magnesium, interspersed with gold. It is frequently found in the Ural Mountains. As a transition to the second class may be regarded the auriferous minerals, in rock of volcanic origin, as it occurs on the west coast of South America and in many parts of Brazil. The granite of the Erz Gebirge, in Bohemia, which contains tin, is a similar formation. Interesting as this class is, considered from a geological stand-point, it is of little practical value to the gold miner.

The next class consists of the auriferous veins, which are fissures filled by hot springs, geysers, or volcanic eruptions. The gold is found here together with silver, as in the case of the Comstock lode, in Nevada, the gold deposits in Queensland and New Zealand, as well as the mines near Kremnitz, in the Carpathian range, in Hungary. The gold is sometimes found in them pure, sometimes mixed with silver, copper, or sulphur. In the older volcanic veins the gold is not mixed with silver, and bonanzas are never found in them. In many of these veins, also, granite veins are encountered, and, although remote from volcanic regions, it is presumed that the gold was carried up by the granite. The celebrated "Mother lode" of California is a sample of this kind.

The third class is the gold-bearing alluvium. This alluvium (earth washed down by rivers upon lower lands) has been produced by the decomposition of auriferous rock, and the gold is found in grains and lumps to the size of a hen's egg. It is a peculiar fact that the gold found in these deposits is purer than that contained in the veins from which it originated, nor is the formation of lumps and grains satisfactorily explained. The deposits of California, Australia, and Siberia pertain to this group, which may again be subdivided into—*a*. Deposits on the earth's surface, from which the gold is obtained by simple washing; *b*. Deposits which have been covered by subsequent inundations, and from which the gold has to be mined only by difficult work and great expense. These old deposits in California are frequently covered with basalt or lava, and are called "deep leads." They are worked by the hydraulic system: the water is conducted through pipes, and directed with full force against the soil, which is hereby converted into a fluid mud, and passes in this condition through a long line of sluices, set in zigzag, in which the particles of gold are deposited.

The most remarkable deposits of this kind are to be found at Ballarat, Australia, where they are covered with four hundred feet of ground and four layers of lava, which have come from a neighboring volcano. These deposits are the banks and bars of former streams,

which have subsequently been filled up. The greatest part of the gold comes from these sources. Dr. Süss estimates that, of all the gold which has been mined between the years 1848 and 1875, the working of the ore has yielded 12·02, while that of the former deposits furnished 87·98 per cent.

Since these deposits are exhausted, attention has for the past few years been directed to the working of the ore. As soon as gold-mines are exhausted, new ones must be found. While the mining of silver is sometimes continued in the same regions for centuries, that of gold is always of short duration, wherefore gold-mines are only to be found in the extreme limits of civilization. Herodotus remarked, when speaking of the quantity of gold-dust paid as a tribute to Darius by the inhabitants of India, that the greatest treasures always come from the most remote places of the earth. The old countries have entirely ceased to be productive, and search must be instituted in the yet unexplored regions in order to discover new fields.

Gold was in excess in ancient times, and mostly taken from the rivers in Asia. The fables of Pactolus, of the golden fleece of the Argonauts, of the gold from Ophir, the history of King Midas, etc., all point to an Eastern origin of this metal. According to Pliny, Cyrus returned with 34,000 Roman pounds of gold (about $10,000,000). The treasures exacted from Persia by Alexander the Great amounted to 351,000 talents, or $400,000,000. Gold also came from Arabia, and upon the Nile from the interior of Africa. Pliny calls Asturias the country in which the most gold is found. A tablet bearing the following inscription was found in Idanha Velha, Portugal: "Claudius Rufus returns his thanks to Jupiter for having permitted him to find one hundred and thirty pounds of gold."

These sources of wealth have ceased to flow, and the endeavor of several Englishmen to reopen them have been unsuccessful. Bohemia, Mähren, Silesia, and Tyrol, all have produced gold, and the receding of the glaciers has caused old mines to be uncovered, while upon the Italian side, at Monte Rosa, Val Sesina, and Val Ansaca, gold-mines are still worked to-day, although with indifferent success. The only works of any note are those of Kremnitz, Hungary. It may, therefore, be safely asserted that Europe is completely exhausted in this respect.

After America was discovered, the Antilles, especially Hispaniola, and the western coast of Mexico, furnished incredible quantities of gold. That used by Alexander VI to gild Saint Mary Maggiore came from Hispaniola, as is seen by the following inscription: "Quod primo Catholici reges ex India receperant." But the production of these mines did not last long.

We find several peculiar statements, with regard to the mining of gold, in an old Dutch book, printed in Amsterdam in the year 1590. It says: "Gold comes from different countries, from the mountains in

Bohemia, and the rivers in Sweden. More than twenty thousand pounds came formerly from Spain, but these mines are exhausted. It came next from the Spanish Indies, first from San Domingo, then from other parts, but that also has stopped. It comes at present from Peru, formerly three millions annually, at present five, six, and eight millions, but it will not be long until these mines also will be exhausted and abandoned." The prophecy of the old book has been fulfilled.

Humboldt entertained great hopes of New Granada and Colombia, where precious metals are found, but, in spite of English capital and highly-improved machinery, the mines do not produce beyond two millions annually.

The Indians of Chili, Peru, and the entire western coast of South America, formerly dug much gold from the alluvium ; they obtained plenty of silver afterward, but little gold, while at the present time they produce ten or twelve times less than at the time of Humboldt's visit. The total production of South America, except Brazil, from 1500 to 1875, was about thirteen hundred million dollars. We can nowhere follow the history of mining better than in Brazil. Toward the end of the sixteenth century the inhabitants of São Paulo were struck with the gold trinkets worn by the savages, and they began washing. In the year 1697 Bartholomeo Bueno found rich gold deposits in the province of Minas Geraes, in consequence of which many adventurers went there, and a war broke out between the Paulists and the Portuguese. The governor finally succeeded in restoring peace, and gold-washing was prosecuted according to a fixed system, whereby the mines became very productive. Towns were built—for instance, Villa Rica—and people flocked from all regions. The province of Matto Grosso, after the year 1720, ceased to produce gold, and in the eighteenth century Brazil occupied the place of California in the nineteenth. Minas Geraes alone, in the middle of the eighteenth century, produced seven, and Brazil ten, million dollars per year, but the deposits were soon exhausted, and toward 1820 the entire production of Brazil had dwindled to five hundred thousand dollars. The leads were next commenced to be worked, but without success, in spite of the vast sums expended upon them by large capitalists. Brazil, which a hundred years ago excelled any other country in the production of gold, has in this respect become fully impoverished within the last fifty years. Its total production, from the end of the sixteenth century up to to-day, amounts to one hundred and sixty million dollars.

In ancient times, and in the beginning of the middle ages, Africa was known as the gold country. Herodotus speaks of the Carthaginians, who gathered gold on the other side of the Pillars of Hercules ; the Arabian geographer El Edrisi (1154) speaks of gold in Wangara, the source of the Niger, and the same mention is made by the Moor, Leo Africanus, who was baptized by Pope Leo X ; he had explored

Africa and the countries of Wangara and Timbuctoo. The Moors of Spain and Northern Africa obtained their precious metals from these countries. The French of Senegal lately took possession of them. They still found gold, but no longer in paying quantities, and the once famous Gold Coast at present furnishes not half a million dollars per year. The auriferous sand is washed by the negroes during leisure hours, and they are content with a yield which would ruin a European enterprise.

The Egyptians obtained their gold from the upper Nile and Ethiopia, attested by inscriptions dating from the year 1600 before Christ. Herodotus mentions a king of Ethiopia who was attacked by Cambyses, but not conquered, who shackled his prisoners with golden chains, since gold was more common than bronze. According to Edrisi, there was so much gold in Sofala that a copper trinket was worth more than one of gold. The celebrated explorer Mauch, in 1867, found the remains of ancient gold-mines, but the gold of Africa belongs to the past. The celebrated necklace of the Queen Aalie Topeh, said to be three thousand six hundred years old, and still to be seen in Boolak; the gold chains worn by the Afghan prisoners at the time of Cambyses; the treasures brought by the Queen of Sheba to Solomon's Temple; the masses of gold with which the throne of the King of Ghana was adorned—all these, no matter whether they be fables or not, indubitably point to the former immense gold wealth of Africa, while to-day it produces barely a million dollars. Entire Northern Africa, as far as the Sahara and the Falls of the Nile, consists of sedimentary ground, which never can have furnished metals; but in the interior we find old rock—granite, gneiss, and hornblende—and there the auriferous alluvial soil had been formed; but it appears that it has been thoroughly exhausted in antiquity and the middle ages. According to Ab. Jevones, the natives have been the first to discover auriferous sand. It is, therefore, possible that the interior country still contains deposits, and even bonanzas, but large ones may no longer be expected, since its gold would long ago have reached the coast.

Neither China nor Japan produces sufficient gold for home consumption.

The three chief sources are at present Siberia, the United States, and Australia, while the last two are becoming exhausted. An immense alluvial territory exists in Siberia, covering the entire space from the Ural to the river Amoor, but the climate prevents washing during the greater part of the year. Here, similar to California, gold is found wherever granite fills the fissures. Although the yield of the washings is gradually decreasing, it is really increased by daily discoveries of new fields, and amounts at present to about $28,000,000 annually. The greatest quantity of gold has of late years been mined in America, partly due to its natural wealth, partly to the energy

brought to bear for obtaining it. Volcanic forces have brought gold as well as silver to the surface in the Rocky Mountains, but its exhaustion is approaching rapidly. Montana, in 1866, produced $18,000,000, while to-day its yield is $2,500,000; Idaho, from 1864 to 1871, yielded from $5,000,000 to $7,000,000, which in the year 1880 has decreased to $1,510,546; Oregon and Washington yielded, in the year 1868, $4,000,000; in 1879, not more than $1,275,000; Dakota has increased a little, and produced $2,420,000 in 1879; Colorado has an average yield of $3,000,000; California has passed through the several stages of a gold-producing country; the washing of the river-sands, after 1848, produced immense wealth, while at present only the Chinese are engaged in it, and earn a bare living. The gold on the surface is exhausted, and only the deep deposits and the veins remain to be worked.

It has been estimated that $1,200,000,000 of gold and silver have been mined in the West of the United States within the last thirty years; and that, in spite of the recklessness and extravagance which characterized the two decades from 1849 to 1869, a net profit of $30,000,000 per year was realized. Since 1850, the money invested and the labor expended in mining in the West for precious metals are estimated at $710,000,000. What may fairly be called the mining territory of the United States embraces an area of 1,190,000 square miles, with a population of barely 1,500,000.

The entire ridge of the Sierra Nevada consists of granite; but on the western slope limestone is found mixed with it. Where these two rocks come together, a belt from eight to nine miles wide, and running from north to south, is found, which contains all the gold leads of the district. The "Mother lode" commences at Mariposa, passes through the northern boundary of the State, and is covered by the lava of the large (not yet extinguished) volcanoes Pilot Peak and Lossan Peak farther north. This lava also covers an old alluvial bottom with overlying layers of basalt from fifty to two hundred feet thick, and these form the so-called "Table Mountains." We find the same formation south of the Sierra Nevada, near the "Big Trees," where the sedimentary deposits, lying upon granite, are covered with basalt. From here the auriferous sand was washed away by mountain-streams, and appeared on the surface. These deep deposits, in connection with the offshoots of the Mother lode, still sustain the gold production of California at from fifteen to seventeen million dollars.

In Nevada was discovered the Comstock lode, for a long time held to be inexhaustible, and this is also covered with later volcanic formation. The largest of these bonanzas is the Gold Hill mine, which lies 700 feet deep, and several companies have commenced to work this rich vein. The most important, the Virginia Consolidated, has sunk a shaft 1,600 feet deep, and driven a tunnel of 20,000 feet in length through the side of the mountain, projected by Engineer Sutro,

so as to work the lead from underneath. But it is, perhaps, too late, because results have not kept pace with expectations; besides this, the heat below in the shaft is so great that work is almost impossible. This bonanza has in ten years furnished $200,000,000, $90,000,000 of which were in gold. The discoverer, Henry Comstock, after having sold his share, committed suicide. The lode, in 1877, furnished $37,911,000, of which $17,771,000 was in gold; in 1878, $10,404,000 silver, and $9,825,000 gold—a total of $20,230,000; 1879, $5,190,000 silver, and $9,725,000 gold—total, $14,915,000; 1880, $2,634,000 silver, and $8,830,000 gold—total, $11,484,000. The total yield of the twenty-eight mines of the Comstock lode has, from $271,000,000 in 1875, sunk to $14,000,000 in 1881. This decrease had a due influence upon the total production of the United States, which was in 1878, $47,266,107; 1879, $38,900,600; 1880, $36,000,000.

The traveler who visits the gold-regions of the United States will everywhere meet with decayed buildings and abandoned localities, which, in former years, were in a flourishing condition.

The gold production of Australia has followed about the same course: first, the washing of the auriferous sand; next, the working of the deep deposits, and, finally, the lodes; after that, again decrease of production. The chain of mountains passing in Australia from north to south consists of sedimentary rock, in places mixed with volcanic. Auriferous veins come up to the surface. The mountains of New South Wales contain veins and sand mixed with gold, which placers were worked for a distance of 180 miles. But the working of the leads was not remunerative, and the gold in the sand was soon exhausted. Production fell from 126,780 ounces in 1876 to 75,492 ounces in 1879.

Where the chain of the Australian mountains passes through Queensland, it attains in places to a breadth of 25 miles, and also here the volcanic rock has carried the gold up to the surface. Large mining establishments, with shafts sunk 600 feet in depth, and producing 70,852 ounces annually, are to be found here.

The German consul in Sydney, Mr. Soetbeer, has arranged the following table, exhibiting the decrease of the Australian gold production:

	Yearly Average.	
	Kilogrammes.	Value in marks.
1856 to 1860	86,700	241,893,000
1861 to 1865	77,700	216,783,000
1866 to 1870	70,400	196,416,000
1871 to 1875	59,900	167,121,000
1876	59,100	164,889,000
1877	52,300	145,917,000
1878	45,300	126,387,000
1879	39,000	108,810,000

Thus we will find a uniform decrease in all parts of the world, and this at a time when the expansion of commerce makes the metal in-

dispensable. If we consider in this connection that America consumes at present a great part of the gold with which it formerly inundated the European markets, we are led to believe that the national economists, Dr. Süss, Robert Giffen, P. Rogers, Patterson Williamson (Liverpool), and others, are not altogether wrong in ascribing the great periodically occurring commercial crises to the want of gold, the sole legal circulating medium. Commercial crises are like fever; after convalescence a certain equilibrium is re-established, soon to be destroyed again, however, and new elements gather, finally producing another crisis. Since America at present spends alone ten million dollars annually for gold and art productions, and, besides this, has reserved a large capital for speculating purposes, while its gold production is decreasing, it may be logically established that the gold for commercial purposes must constantly diminish, and financial crises will recur in ever-shortening intervals.—*Fortschritt der Zeit.*

"NATURAL RELIGION."

A STUDY IN THE GROWTH OF SCIENTIFIC MORALITY.

By R. W. BOODLE.

IN estimating the importance of the new work by the author of "Ecce Homo," it will help us to pass shortly in review the religious history of the last thirty years. We shall better understand the nature of the epoch in which we are living, and be able to appreciate how far the author of "Natural Religion" is justified in offering what appears at first sight a one-sided *eirenicon*. In my review I will begin from the year 1850, not only because it is a convenient starting-point as the half-century, but because it is marked by the publication of Tennyson's "In Memoriam," a poem which, in its own day, appeared to many people, like Pope's "Essay on Man" a century before, a convincing answer to the cavils of free-thinkers. That its influence even at the time was overrated will appear certain, when we consider the group of works among which it appeared. In the same year were published Carlyle's "Latter-Day Pamphlets," containing protests so often repeated by the prophet-voice of the nineteenth century against the current state of thought in politics and religion; "Phases of Faith," by the younger of the two gifted brothers, of whom the elder took refuge in the Church of Rome, the other in an extreme form of skepticism, as the logical result of Protestantism. Next year came Carlyle's "Life of John Sterling," revealing the hollowness of Coleridge's religious compromises; and Greg's epoch-making work, finally revealing for scientific minds the small basis of the

entire "Creed of Christendom." But, perhaps, Matthew Arnold's "Empedocles on Etna," which appeared in 1853, best enables us to appreciate the religious state of the younger generation. The soul of man hangs like a mirror, blown upon by every wind, and—

"A thousand glimpses wins,
And never sees a whole."

Man is the sport of the gods, man—

"Who knows not what to believe,
Since he sees nothing clear,
And dare stamp nothing false where he finds nothing sure."

The gospel of the writer is that of Stoicism:

"Once read thy own breast right,
And thou hast done with fears;
Man gets no other light,
Search he a thousand years."

He repudiates all compromises such as that which had been offered by "In Memoriam":

"Born into life!—who lists,
May what is false hold dear,
And for himself make mists
Through which to see less clear;
The world is what it is, for all our dust and din.
. . . . . .
"Streams will not curb their pride,
The just man not to entomb,
Nor lightnings go aside
To give his virtues room;
Nor is that wind less rough which blows a good man's barge.
. . . . . .
"Fools! That in man's brief term
He can not all things view,
Affords no ground to affirm
That there are gods who do;
Nor does being weary prove that he has where to rest."

The impression one gets from such a poem is one of despair; the agnostic tone is quite as pronounced as that of any writer at the present day; but there is much less hope, no outlook into the future, no talk of the future destiny of humanity, which, however vague and dreamy, is better than the dead level of an agnostic introspection. And yet this poem was written by one whose contemporary writings are quite free from this despairing tone, who has faith in a tendency not ourselves, and believes that we can learn something of it from the Bible and the best literature of all ages. This change in tone, which is not peculiar to Matthew Arnold, I attribute to a great extent to the new vistas opened up by the school of evolutionists, and by the writers

who have drawn attention off mere umbilicular contemplation such as Morris, Rossetti, and Swinburne. We have accordingly to trace in the succeeding years the rise of new schools of thought, as well as the several attempts of religious writers to accommodate traditional religion to the new light thrown upon it. This will take us through twenty years, up to the memorable years 1873–'74, when the different schools came into open antagonism.

To trace out the different lines of thought with any fullness would require a separate study; as I am simply passing over the ground with the view of setting a single book in a clearer light, I must content myself with mentioning the names of a few leading works, with their dates. The rise of the evolution school was heralded in 1845 by Robert Chambers's "Vestiges of the Natural History of Creation," an expansion of the Lamarckian theories of natural development. But the writings by which what we now mean by evolution were popularized fall within the present period. "The Origin of Species" appeared in 1859, Spencer's "First Principles" in 1862, Huxley's "Evidence as to Man's Place in Nature" in 1863, and "The Descent of Man" in 1871. With this school also we may class Max Müller's "Lectures on the Science of Language," which appeared in 1861, as tending to widen the conception of evolution. Of the effects of this new view of life upon religious thought it is not too much to say that, if it cut the ground from under the intuitionalist theory of right and wrong, and of the origin of conscience, to the skeptic in regard to supernaturalism it gave a prospect and a future glorious with hope. To many minds the ascent of man serves a more glorious conception than his fall. The door was opened for a pantheistic view of the universe, and this tendency was enhanced by the influence of Ruskin, who was already writing in 1850. George Eliot, who has exercised a distinct influence upon the age by popularizing the ethical side of positivism, and showing men that it gives a work-a-day theory of life, began to publish in the year 1858.

What has been called the fleshly, and more recently the æsthetic school of poetry, is best represented by the names of Swinburne, William Morris, and Dante Gabriel Rossetti. Swinburne's works are too numerous to mention, but his "Chastelard" appeared in 1865, his "Poems and Ballads," of unhappy notoriety, in the following year; Morris's "Defense of Guinevere," his first work, appeared in 1858, his "Earthly Paradise" in 1868; Rossetti's first celebrated volume of "Poems" appeared in 1870. Of this school it may be said that, without being brought into actual contact with supernaturalism, the tendency of their writings was to take men's thoughts into a different field, to consecrate the passions and sentiment, to revive with a difference the old Greek modes of looking at man and his destiny in the world. With this school we must rank the important name of Walt Whitman, whose first series of "Leaves of Grass" came in 1855. Of course his influ-

ence was more catholic than that of the fleshly school, properly so called, his aim being the apotheosis of man as man. Three lines from "One's Self I Sing" reveal to us clearly his point of view:

"Of physiology from top to toe I sing;
Not physiognomy alone, nor brain alone, is worthy for the Muse—I say the form complete is worthier far;
The female equally with the male I sing."

Of what may be called skeptical writers, i. e., writers who treated different branches of study in a manner hostile to Christianity, and with their eyes distinctly turned upon it, it will be sufficient to mention Buckle, whose "History of Civilization" appeared in 1857; Draper, whose "Intellectual Development of Europe" was published in 1861; and Lecky, whose "Rationalism" appeared in 1865, and his work on "European Morals" in 1869. Dr. Jowett's "Plato" appeared in 1871, the introductions to the separate dialogues of which were a distinct contribution to contemporary thought, while they are valuable as a fair index to the results of moderate liberalism of the time in different fields. Thus, in his introduction to the "Republic," he defines the modern notion of God as an "intelligent principle of law and order in the universe, embracing equally man and nature." Spencer's "Study of Sociology" appeared in 1872, and the "Fortnightly Review" was started in 1865. In tracing the line of thought taken by writers more immediately concerned with the book before us, we come first to "Essays and Reviews" in 1860. Archdeacon Pratt had published, in 1856, an attempt to prove that Scripture and science were not at variance. The publication of the volume of "Essays and Reviews" may be taken as a symptom that intellectual Churchmen felt that the old stand was no longer possible; that concessions must be made to modern science, modern investigations, and modern thought; that the proper way to judge of an ancient work was to interpret it by the light of its own day. These views were to some extent popularized by the first series of Stanley's "Lectures on the History of the Jewish Church," appearing in 1863, the year following the publication of Bishop Colenso's work on the Pentateuch and the Book of Joshua. Stanley's preface tells us that it is his intention "to present the main characters and events of sacred narrative in a form *as nearly historical as the facts of the case will admit*"; to set the characters and institutions of the time in a clearer light; "to *recognize in sacred subjects their identity with our own flesh and blood*," at the same time not "wishing to efface the distinction which *good taste*, no less than reverence, will always endeavor to preserve between the Jewish and other histories." "Ecce Homo" appeared in 1865. It was an attempt to base religion upon the enthusiasm of humanity as preached by the man Christ, and was succinctly characterized at the time by a pious nobleman as "vomited from the jaws of hell." The author, now uni-

versally recognized as Professor Seeley, promised a supplementary volume of applications of his theory. This has never appeared, and we may look upon the present work as the fulfillment of his promise. The wide difference between them must be ascribed to the progress since made by liberal thought. Still, "Ecce Homo" was regarded with fear and disgust in its day by the orthodox among all sections of Christianity, and at once provoked an eloquent and, from Professor Seeley's point of view, unanswerable rejoinder in Dr. Liddon's Bampton Lectures "On the Divinity of Christ," delivered at Oxford in the following year.

We now come to the two celebrated years 1873 and 1874—years of open utterance on all sides, and which we may look upon as the crisis of the revolution of thought. In these years appeared the first two volumes of "Supernatural Religion," an elaborate investigation from two points of view into the foundations of Christianity, and Matthew Arnold's "Literature and Dogma," an attempt to rehabilitate Christianity, while openly recognizing the futility of all attempts to base it upon miracles or the supernatural. Christianity was to remain in force, but without a personal God. At such a moment, Leslie Stephen's direct question, "Are we Christians?" came home to us with full force. It was anticipated, by one year, by the amusing *brochure* entitled "Modern Christianity, a Civilized Heathenism." In the same year Max Müller carried the critical spirit of science into religion itself in his "Introduction to the Science of Religion." Meanwhile, there appeared a beautiful volume, carefully printed upon exquisite paper, containing "Studies in the History of the Renaissance," which their author, Mr. Pater, concluded with the following words: "We are all *condamnés*, as Victor Hugo says, '*Les hommes sont tous condamnés à morte avec des sursis indéfines*'; we have an interval, and then our place knows us no more. Some spend this interval in listlessness, some in high passions, the wisest in art and song. For our one chance is in expanding that interval, in getting as many pulsations as possible into the given time. High passions give one this quickened sense of life, ecstasy and sorrow of love, political or religious enthusiasms, or the 'enthusiasm of humanity.' Only, be sure it is passion, that it does yield you this fruit of a quickened, multiplied consciousness. Of this wisdom, the poetic passion, the desire of beauty, the love of art for art's sake, has most; for art comes to you professing frankly to give nothing but the highest quality to your moments as they pass, and simply for those moments' sake."

In 1874 appeared Green's "Short History of the English People," of the importance of which I shall speak presently; Mill's "Autobiography," revealing the blameless life of a true humanitarian who had lived without a God, in the ordinary acceptation of the term; and George Eliot's "Jubal, and other Poems." In this volume the religious aspirations of the new faith were thus given poetical expression:

"O may I join the choir invisible,
Of those immortal dead who live again
In minds made better by their presence: live
In pulses stirred to generosity,
In deeds of daring rectitude, in scorn
For miserable aims that end with self;
In thoughts sublime that pierce the night like stars,
And, with their mild persistence, urge men's search
To vaster issues. *So to live is heaven.*"

In this year, too, at Belfast, Professor Tyndall delivered, before the British Association, his celebrated address, in which, "abandoning all disguise," he says that "the confession that I feel bound to make before you is, that I prolong the vision backward across the boundary of the experimental evidence, and discern, in that matter which we, in our ignorance and notwithstanding our professed reverence for its Creator, have hitherto covered with opprobrium, the promise and potency of every form and quality of life."* The discovery, if it may be called so, was not exactly a new one. The same avowal had been made, more than twenty years before, by W. B. Carpenter, but the rise of the evolution school in the interim caused an importance to attach to Professor Tyndall's utterances that has not attended upon Dr. Carpenter's.† The address at once took rank as the high-water mark of materialism. Lastly, in the same year, we come to Greg's "Warnings of Cassandra," and to a work which, together with this, is symptomatic of the feelings of the next few years—Hartmann's "Philosophy of the Unknowable."‡

The prevailing tone, after the battle had been fought, was one of despair and pessimism. Science had won the victory, but thoughtful minds, even on that side, saw that it might be possible to push it too far. Hence came attempts at compromise, the cry for which went up, in 1874, from John Morley, the editor of the "Fortnightly Review," the chief Positivist organ. Still, for the present, the general tone was disheartening in the extreme, and its influence is traceable in many ways. Poetry has been distinctly deteriorated by it. In politics it led to a temporary reaction in favor of conservatism. Life appeared to be, as Pope had said, a mighty maze, but the plan was lost. Instead of the authoritative tone of the Church, the voices of different

* Quoted from the original, as reprinted in "Nature." The passage is reworded in the published address. The variations between the two are curious, and well worthy of study.

† For Dr. Carpenter's words, see his article upon "Life," in Todd's "Cyclopædia of Anatomy and Physiology," vol. iii, p. 150. This work appeared in 1847. He refers, in a foot-note, to an earlier essay, on the laws regulating vital and physical phenomena, in the "Edinburgh Philosophical Journal," April, 1838.

‡ I may here remark that I have confined my review to works in the English language. Many foreign names, such as Strauss and Haeckel, will occur to every one. To have extended my review to these would have required a separate essay.

schools were heard bidding against one another for adherents. This condition of affairs was cleverly brought home to readers by "The New Republic," Mr. Mallock's first work, appearing in 1878. To minds distracted by the hubbub of opinion, and despairing of certainty elsewhere, the only sure refuge again appeared to lie in the Church of Rome, and this, as the only alternative for the gospel of Positivism, was offered in the book entitled "Is Life worth Living?" which was published in 1879. "The Romance of the Nineteenth Century" appeared two years afterward. Such a temporary depression of tone was a natural result of the conflict through which the age had been passing.

But other and more important results followed. It is unequivocally recognized, by most writers of eminence, that Christianity can no longer look to its supernatural elements for support—nay, more, that the excellence of some parts of its morality can not even receive credence for their inferential elements; at least they have to be definitely discarded as a necessary part of faith, if Christianity intends to bid for the allegiance of the intellectual portion of mankind. It is therefore ridiculously wide of the truth to boast, as the clerical mind is inclined to do, that Christianity has weathered the storm, that she will pass into the twentieth century unaltered in essentials. This is fully recognized by the author of "Natural Religion." "The Church," he writes, "has now entered upon that phase when minds of the higher order are seldom found to receive its ancient dogmas with complete conviction, when they do not altogether belong to it, even when they most admire it, and most appreciate the service it has rendered to mankind. It has reached this rather advanced stage of decline, and has left quite behind it the first stage when individual disbelievers were indeed numerous enough, but still minds disposed to religion, even when they were minds of the highest order, were troubled with no skepticism that they could not overcome." The fact is, that the Church does not pretend to be the interpreter of human society, to open to us the vista of the future, or to give us guidance upon matters of contemporary importance. "We know," writes our author, "that for the most part it is occupied with quite other topics. To most of its utterances the world listens in half-contemptuous silence, feeling that it is useless to controvert the propositions laid down, and that no results would follow from admitting them. The propositions are *archaic;* they show that the Church *once* understood its function, and discharged it efficiently."

The natural result has been, that its authority has been quietly disregarded by all branches of investigation. Before 1873 and 1874, hostility to orthodox Christianity was more or less openly shown by the chief writers of science, history, art, morals, etc., but since these years this tone has been generally abandoned for one of supreme indifference, or of perfect fairness. The tone of the "Fortnightly Review,"

which had led the van in the attack on the Church, has visibly changed, and has thrown aside the unfairness and Positivist provincialism, which was its note ten years ago. Thus, again, instead of covertly sneering at the marvels of the Bible and Christianity, as Grote and Buckle loved to do, Mr. Green finds no difficulty, in his "History," in fully acknowledging all that the Church had done for the civilization of England. But this does not close his eyes to the facts of the case, or prevent his recognizing, in the Bible literature, a heterogeneous collection of "legends and annals, war-song and psalm, state-rolls and biographies, etc." It should be remembered that Mr. Green's history was intended for the student; that it was written by a clergyman, and one who had been an earnest worker in the purlieus of eastern London; and, lastly, that this free tone in regard to matters of religion, a tone that recognized with equal impartiality Protestant and Catholic, has never been objected to as unfitting the book for general use. Thus we may say that history has been emancipated. The revision testifies to the emancipation of scholarship.

Another important result of the battle of opinion was the perfect freedom with which different writers now expressed themselves, as well as in the toleration that they mutually extended to one another. As it were to mark this era, a new review was started in March, 1877, as a perfectly free medium for all shades of honest opinion. A poem was contributed by the poet-laureate as a preface, which we quote as distinctive of the "Nineteenth Century":

"Those that of late had fleeted far and fast
To touch all shores, now leaving to the skill
Of others their old craft seaworthy still,
Have chartered this; where, mindful of the past,
Our true co-mates regather round the mast,
Of diverse tongue, but with a common will
Here, in this roaring moon of daffodil
And crocus, to put forth and brave the blast;
For some, descending from the sacred peak
Of hoar, high-templed Faith, have leagued again
Their lot with ours to rove the world about;
And some are wilder comrades, sworn to seek
If any golden harbor be for men
In seas of Death and sunless gulfs of Doubt."

But on two sides something more is observable. Art and science not only claim to be completely free from the power of Church dictation; they have set up, so to speak, an opposition Church. Science was emancipated in 1874, it has since turned its attention to the construction of a scientific morality. The "Data of Ethics" appeared in 1879, but long before this science had shown itself capable of rising to the enthusiasm of a religion, and we have to thank the author of "The New Paul and Virginia" for laboriously collecting the utter-

ances of men of science upon this point in the notes appended to that work. It is true that all men of science do not associate their worship with the name of God, but we are fully in agreement with our author when he writes: "By what names they call the object of their contemplation is in itself a matter of little importance. Whether they say God, or prefer to say Nature, the important thing is that their minds are filled with the sense of a Power to all appearances infinite and eternal, a Power to which their own being is inseparably connected, in the knowledge of whose ways alone are safety and well-being, in the contemplation of which they find a beatific vision."

The claims of art to an independent position, to a right to the undivided attention of its votaries, are no less unequivocal. When W. Morris published his "Earthly Paradise" in 1868, he prefaced it with an "Apology," in which he acknowledged the littleness of his undertaking, almost lamenting that he could not rise to higher work:

"Of heaven or hell I have no power to sing,
I can not ease the burden of your fears,
Or make quick-coming death a little thing,
Or bring again the pleasure of past years,
Nor for my words shall ye forget your tears,
Or hope again for aught that I can say,
The idle singer of an empty day."

He only professes to tell

". . . a tale not too importunate
To those who in the sleepy region stay."

I have quoted Mr. Pater's claim for art put forth in 1873. Listen, lastly, to the terms in which the newest singer bids his soul abandon the secular world:

". . . O come out of it,
Come out of it, my soul, thou art not fit
For this vile traffic-house, where day by day
Wisdom and reverence are sold at mart,
And the rude people rage with ignorant cries
Against an heritage of centuries.
It mars my calm: wherefore in dreams of Art
And loftiest culture I would stand apart,
Neither for God, nor for his enemies."

To sum up the intellectual and religious revolution of the last few years: Matthew Arnold's poetry aptly represents the tone of mind of advanced religious thinkers during the fifties. Looked at from the orthodox stand-point, his poems are intended, like the reasonings of the devils in hell upon theological problems, to—

". . . arm the obdured breast
With stubborn patience as with triple steel."

Matthew Arnold aptly expresses his own point of view when he speaks of himself as

> "Wandering between two worlds, one dead,
> The other powerless to be born,
> With nowhere yet to rest my head."

or, again:

> "... The sea of faith
> Was once, too, at the full, and round earth's shore
> Lay like the folds of a bright girdle furled,
> But now I only hear
> Its melancholy, long, withdrawing roar,
> Retreating to the breath
> Of the night-wind, down the vast edges drear
> And naked shingles of the world."

Meanwhile, as the old faith began to lose power, art, science, and the religion of humanity stepped forward into prominence, at first in antagonism to Christianity. The struggle became critical during the years 1873–'74, and left a feeling of despair and pessimism for a time on men's minds. But with time this feeling has begun to wear off, and we see that the allegiance formerly claimed for the old theology is claimed now by its rivals. The interval of pessimism, the period of dormant anarchy, was marked by many gropings in different directions. Scholars drew attention to the great rivals of Christianity, to Judaism, to Mohammedanism, to Buddhism. To this we owe in part such books as "Daniel Deronda" (1876) and "The Light of Asia" (1879). The theories of great philosophers of the past began to be studied with fresh attention, especially the writings of Plato and Aristotle, of Berkeley, Spinoza, and Kant. Even spiritualism and the doctrine of metempsychosis were found to give the support needed to unscientific souls who lacked the courage to stand by the old orthodoxy which the *Zeit-geist* had condemned.

The need of some reconstruction was felt even by philosophers of the new school. Spencer propounded an evolution theory of morals in his "Data of Ethics" (1879); and George Eliot, as a reconstructive radical, in her "Theophrastus Such" (1879), drew attention to the fact that "ideas acquired long ago reappear as the sequence of an awakened interest or a line of inquiry which is really new to us." As stable elements of the religion of the future, she pointed to the love of ideals, and specially to the constantly renewed ideal self; to the value of external nature, as exercising a soothing influence, of family life, and of national sentiments. We are thus led to the work before us. Its importance is due to its recognition of the facts which this short review of the religious thought of the last thirty years has brought into prominence, and it takes up and makes a part of its system the ideas on culture and civilization, which Matthew Arnold has reiterated at intervals, ever since his publication in 1869 of "Culture and An-

archy." I have called it a system, and herein lies its weakness as well as its strength. "Theophrastus Such" was a distinct contribution to the thought of the time, but, through not aiming at the completeness of a system, it failed to secure the attention which would have revealed its short-comings. Many parts of "Natural Religion" are doubtless of great value, but what a writer does not seem to have great faith in personally is not likely to be warmly welcomed by outsiders.

[*To be continued.*]

SCIENTIFIC PHILANTHROPY.

By M. ALFRED FOUILLEE.

II.

WE have examined, subjecting them to their just measure, the inconveniences which philanthropy produces when it takes as its rule the vague sentiment of love instead of the precise and scientific ideas of justice and general interest; it is proper for us to show the advantages which can, in a certain measure, compensate for these inconveniences. This is a point of view on which the Darwinians have not sufficiently insisted.

The first advantage of philanthropic institutions, when they are well conceived and subordinated to the rules of science, is, that they tend to diminish excessive inequality, whether economical, political, or intellectual, among men. The necessity of restoring some degree of equality in mankind arises from the laws of natural selection themselves. It is a remarkable fact that these laws, after having at first appeared favorable to aristocracies and aristocratic institutions, are now invoked in favor of social equality. According to Dr. Jacoby, political and economical inequality, even by virtue of the laws of natural selection, produce "ignorance and misery below, crime and sterility above. . . . From the mass of mankind emerge individuals, families, and races, who tend to rise above the common level; they toilsomely scale the rugged heights, attain the summit of power, of wealth, and of intelligence, and, when once they have got there, they are cast down and disappear in the depths of folly and degeneracy." Death is the great leveler; by destroying everything that rises, it democratizes mankind. "Men thus appear to have been organized," according to Dr. Jacoby, "with a view to equality." Every too abrupt distinction into classes, political, economical, or intellectual, and all selection, which is the logical and natural consequence of such distinctions, are equally disastrous to mankind, to the elect as well as to the rest of men; "they produce with the latter deficiency, with the former ex-

cess of the element which is the principle of the distinction of classes." Whenever any part of mankind has too much of anything, whether it be of material goods or intellectual qualities, the rest of the race immediately finds itself having too little, and both parties suffer equally from the excess and from the lack. But Nature seems to desire to avenge herself for such violations of her laws, and cruelly afflicts the elect and fortunate ones, chastising them "to the fourth and seventh generation."

The laws of Nature are immutable, and woe to the man who violates them! "Every privilege a man accords himself is a step toward degeneracy, mental decline, and the death of his race." By abasing whoever tries to raise himself above the common level of mankind, by chastising the haughty, by exacting satisfaction for excess of pleasure, Nature appoints the privileged ones themselves the scourges of their race. "Too much fortune offends and irritates the gods," the ancients thought, and the medical study of the consequences of all intellectual or moral distinction, and of all selection, leads us to the same conclusion. "*Humana imprudentia impares esse voluit quos Deus æquaverat*" ("Human folly desires to make unequal those whom God has made equal"), said Pope Clement IV, but, if this is the case, can the Darwinians complain that philanthropy is trying to diminish in some degree the inequalities that are born of the social *régime?* Does it not, in this case, act in the same direction with Nature, and according to its design?

We should, besides, be less pessimist than Mr. Jacoby in respect to distinctions and selections of every kind. The theory which Mr. Jacoby has deduced from Darwinism, if pushed to the extreme without making necessary distinctions and restrictions, would go to the extent of destroying even the principles from which it is drawn, and would overthrow the laws postulated by Darwin; in effect, all superiority, requiring an expenditure of force, might, by that fact itself, become in the struggle for existence a germ of degeneracy instead of a germ of improvement. There would be nothing really durable except what did not rise above the common level, and living beings would resemble those corals, the madrepores, which grow to form the basis of continents as long as they do not pass the level of the sea, and are not brought to die above the level of its surface. It is necessary to distinguish here between useful and injurious inequalities, between natural and acquired ones; among the last, also, must be distinguished those which are in accord with Nature, and those which are opposed to her. These distinctions, too much neglected by Mr. Jacoby, are the very ones, in our opinion, which scientific philanthropy ought always to have in view. Its aim should be to re-establish, so far as possible, a degree of equality at those points where social arrangements have created artificial inequalities, injurious and contrary to Nature. To spread and equalize general instruction, the moral sen-

timents, labor, the first and essential instruments of labor, to raise what is down, to bring up to the common light what is in darkness, to restore to life and health what on account of want was threatened with sickness or death, is to do real reparative justice, and at the same time to re-establish some equality among men in the great competition of life; it is by this very fact to suppress factitious inequalities in order to give free play to natural superiorities, in essence beneficent and no longer malign. It is, we see, the theory of natural selection itself coming to the support of the philanthropic sentiments against which it had furnished objections.

May not this preservation of the weak, which the partisans of Darwin condemn, while it may sometimes become dangerous to the physical health of the race, also save from death useful or even superior minds who, without the cares given by the family or the aid rendered by strangers, might not have been able to live and develop themselves? Do we have to lament that a Pascal and a Spinoza were rescued from the death with which their feeble constitutions threatened them from their youth? How many poor children have there been who, by means of the aid they have received, have afterward become great men of science or great artists! Here, then, is a second advantage of philanthropy. After correcting injurious inequalities, it favors useful superiorities. Furthermore, the preservation of organisms which want would otherwise have destroyed, induces, by virtue of the competition of life, an increasing elevation of intelligence which becomes continually more necessary: all those who can not count on the vigor of their limbs are obliged in the struggle for existence to appeal to their mental faculties. Other men have had to employ considerable intelligence to save them from death, and they are themselves obliged to employ it in their turn to preserve themselves, to support themselves, to secure for themselves a place in the light of the sun. Hence arises a progressive elevation of the intellectual level in the whole mass of the nation. This movement is, in many points, nothing but that of civilization itself, to which philanthropy is correlative.

We meet here a new objection: it is represented that talent, and still more genius, are advantages of individuals which are paid for at the expense of the race. We hear it repeated, with Plato, that a soul which is mistress of itself will knock in vain at the doors of poetry; with Aristotle, that there is no great genius without a mixture of folly; and with Seneca, that nothing great or superior to what is vulgar can be manifested without some trouble of mind; more than this, the objectors would extend to the race of the great man the trouble and the morbid germ which, working itself out in some form or another, will make the children pay dearly for the fame of their fathers. "Every man of genius or talent," says M. Renan, "is a capital accumulated from several generations." "This capital, accumulated

and personified in a man," says M. Jacoby, "does not return again to the commonwealth, but is lost from it, at least in a physical point of view; it is withdrawn from circulation, and the only trace it leaves is folly, wretchedness, and degeneracy in posterity." Nothing is made out of nothing, and all production supposes some consumption. Science, art, and ideas, to be born and develop themselves, consume generations and peoples. Individuals and nations exhaust themselves by production, like lands not manured, because the products are not returned to the common ground, and are materially lost to it. M. de Candolle also shows that civilized man, by the very fact of his mental superiority, is generally inferior to the savage in physical force and health. With the savage, in fact, the chief conditions of selection are a piercing sight, a fine hearing, muscular strength, and the faculty of resisting cold, heat, moisture, and hunger. The civilized man has not these qualities in the same degree; what he gains on one side he loses on the other, and the law of equivalence of forces is verified here as elsewhere. The brain grows only at the expense of the muscles; the man who thinks is in a sense a depraved animal. Such are the inconveniences of the intellectual development which modern philanthropy tends to favor at the expense of physical force. We are far from desiring to deny these inconveniences, but conclusions which go further than the premises need not be drawn from them. Social science is doubtless right in saying it is dangerous for individuals and peoples to break entirely the natural equilibrium of physical and mental functions: *mens sana in corpore sano* (a sound mind in a sound body); if a nation becomes physically enfeebled too rapidly, it will have neither time nor means to fortify itself mentally, for intelligence can not make real progress in decaying organisms; all will end in a simultaneous dwindling of mind and body. But it is necessary, on the other side, to look out that the natural movement of civilization be not trammeled. Now, this movement is characterized by the increasing predominance of thought and feeling among modern nations. This predominance favors the development of philanthropy, and is in its turn favored by that through an inevitable reaction. The question of philanthropy, then, when generalized, ultimately becomes confounded with that of civilization itself. Now, it would not do to repeat to-day Rousseau's dissertation against inequality and the arts; we could not take man back to the savage state under the pretext that civilization exhausts his physical forces and the best of his vigor in the intellectual blossoming. The whole of society, in profiting by the discoveries of science or art, profits by the sacrifice of individuals or of their immediate posterity, if there is a sacrifice, and the profit exceeds the loss.

This loss even might be avoided by a better understanding of hygiene and a better system of education; and precisely these ought to be the principal aims of philanthropy. Hitherto the economy of nature, in order to repair the loss incurred by intellectual culture, has

been obliged to proceed by a kind of fallowings, by suffering a vegetation too luxuriant and too concentrated at one point to be succeeded by a provisory rest and sterility; but a superior system, which has prevailed in the cultivation of the land, will without doubt be applied some day to the cultivation of the mind: it is the system of allotments and improvements, and it should be made the basis of general education. We can, furthermore, avoid at this point, also, the excessive evils of repartition, the antinomies of intellectual luxury and intellectual want, by the diffusion of knowledge through the mass of the nation; and this is one of the essential objects and one of the beneficent results of scientific philanthropy. Without that, mankind, divided into a class of intelligent men and a class of ignorant ones, would resemble the twins of Presburg, who were united by the after part of the thorax. One of them was bright and gentle, while the other was stupid and ill-natured, and constantly struggling against her sister, notwithstanding both their bodies were united into one; and her violent conduct did harm to both.

In addition to the material and intellectual advantages we have just demonstrated, philanthropy brings precious moral advantage to the whole race. It develops, in the individuals and the people who exercise it, the qualities of heart most important for social life. Darwin and his partisans early recognized how essential to society is the development of altruistic inclinations; even justice is impossible without those inclinations, for they alone can restrain egoism. A society without pity is always careless of the right. Natural selection, which is exercised now to the advantage of the most intelligent peoples, will also in the future, we hope, be exercised to the advantage of the best and most just, when the understanding of the truth shall be complete enough to win over the will of the best. Selection always gives the day to those who adapt themselves most perfectly to the new medium; and the human medium of the future will without doubt be the reign of fraternity and justice. Those nations only will survive then which shall be best adapted to the altruistic type; that is, which shall be able to live best and to propagate themselves in a medium chiefly intellectual and moral, in which knowledge and sympathy shall have the first rank.

This adaptation of actual societies to the ideal society by the simultaneous advance of science and sympathy, will probably bring about a transformation of the type of the species, a greater development of the brain than of the other organs, a substitution of mental and moral strength for physical force. The actual brain is already an immensely enlarged vertebra; the brain of future races will perhaps be not only in volume but in organization, also and especially, as different from the brain of existing races as that is from simple vertebræ. The nervous system of civilized man is already thirty per cent greater than that of the savage. Now, cerebral development seems to have a re-

strictive influence on fecundity; it should tend, then, to re-establish that equilibrium between the increase of population and the increase of subsistence which scientific philanthropy seeks to realize, and which it reproaches sentimental charity with destroying. The point is worthy of examination.

What are the laws of the multiplication of species, neglect of which, according to Malthus, Darwin, and Mr. Spencer, is as prejudicial to the philanthropist as to the naturalist, in the connected problems of population, selection, civilization, and benevolence? The first of these laws, as formulated by Messrs. Howorth, Doubleday, and Spencer, is that a greater development of individuality brings on a diminished fecundity for the species: if animals of one species, the human species, for instance, have a more intense individual life than those of another species, the progress in the volume of the brain, in physical or moral development, and in the complexity and activity of the functions, is compensated for as to that species by a lessened generative aptitude. Man is the living species in which individuality and its functions are carried to the highest point; and it is also the least prolific of the species. The reason of this law, according to Mr. Spencer and M. de Candolle, is that the intensity of the individual life implies a taking possession of materials which can no longer serve for other organisms; generation, on the contrary, is a disintegration which subtracts from the organism a part of its substance. In short, individuality is an acquisition; generation is a loss. Now, that which completes individuality, which is what we might call its highest expansion, is the life of the intellect and affections. Consequently, the animal species, or the human races that live most by thought and feeling, are those which have the least generative power. To the objection that, in fact, civilized races are more numerous than others, Mr. Spencer answers that civilization, by diminishing a host of destructive forces, augments the means of subsistence, and thus maintains population at a superior figure; but the height of this figure is dependent on individuals having a greater faculty of conserving themselves, not on the species having a greater generative power.

The second law that regulates the multiplication of beings is, that richness of nutrition augments fecundity, while the expenditure produced by the exercise of the functions of relation, and chiefly the intellectual expenditure, diminishes it. Poor and badly-fed races are naturally the least prolific. The Irish seem to form an exception; but the increase in number among them is dependent on their marrying early (whence is derived a faster succession of generations), and on their improvidence in imposing no restraint upon themselves; in short, upon quite other causes than the generative force proper. Reciprocally, the increase of the vital expenditure, especially of the intellectual expenditure, tends to lower the degree of fecundity. This law still proceeds from the same principle: that what the individual ac-

quires or expends on his own account and for the exercise of his own personal functions he can not transmit again by generation to other individuals.

It is certainly not proper to push the preceding biological inductions, the truth of which is only general, to extremes. Mr. Spencer himself has not always kept the measure or avoided inexact intepretations of the laws in question. Practically, and in the actual condition of affairs, the superior races and the individuals belonging to those races, do not lose their generative power except when they give themselves up to what we might call intellectual debauchery. But sterility rarely comes from this cause. Man can nearly always, even when he abandons himself to mental labors, maintain a procreative power fully equivalent to that of the woman with whom he is mated, and it is unreasonable to demand more of him. It is, then, the woman that must be considered, looking at the question from this point. Mr. Spencer remarks, in support of his thesis, that the women among the higher classes, in whom mental labor is carried to excess, are relatively infertile; but there are also several elements to be distinguished here. The women of Paris have, for instance, a weight of brain which, according to the anthropologists, raises them but little above negresses: they should, then, by the theory we are considering, be very fertile, like the negresses; but the contrary is the case. The real reason of this is, that while the brain of a Parisian woman is definitively but little overstocked with ideas, her whole body is still less developed than her brain; but it is not so with the strong-limbed negresses. Why has the body of the Parisian woman been arrested in its development? Do not lay it to her intelligence, but to her want of intelligence, to costumes and fashion, to bad hygienic conditions, to parties, vigils, balls, and theatres; to the activity, at the same time feverish and frivolous, of a wholly worldly life in an air more or less vitiated. In the same way, if the daughters of aristocratic families are relatively infertile, there is nothing to prove that their infertility arises from mental labor. In short, whenever mental labor is really a cause of diminished fertility, it is so by being excessive, and not by its well-regulated exercise. The same is the case with every excess of labor, even physical; the common workman or laborer may exhaust himself as much as the thinker. Mr. Spencer has not sufficiently distinguished here between the normal and the exaggerated exercise of the brain. A normal exercise, in which the functional expenditure is not above the nutrition of the organs, but below it, does not appear to us to diminish fecundity, or, at least, does not diminish it enough to trammel the development of the species. In the normal individual, intellectual productivity and sexual productivity march in line; they are, as it were, the two poles at which the excess of nutrition is expended after a right fashion; but, in case one of the poles draws all to itself, it is evident that the other pole will lose correspondingly. The almost exclusive

direction of an energetic nutrition toward a particular function results in the exaltation of that function and the depreciation of all the others; it might even create a kind of physiological monstrosity.

It is, then, the excessive and abnormal application of the brain that diminishes by compensation the generative vigor; and, still more, the bad hygienic conditions under which thinkers live, and, perhaps, the pressure of necessity, causing them to overwork themselves. Among the people who lead the march of civilization, the minorities who work excessively for the advancement of that civilization quickly exhaust themselves, and have to be replaced by new generations. This is the cause of the relative sterility of cities as compared with the fecundity of country places. The centers of intellectual life, the great cities, are, to M. Jacoby, the Minotaurs of civilization; but this is not only, as M. Jacoby seems to believe, because they think too much in the great cities, but because they think badly and live contrary to all the rules of hygiene. The biological law accepted by Mr. Spencer is true only in its most general principles, not in the extreme consequences which he has drawn from them, while special circumstances may intrude many a perturbation among the effects of the law.

In every case a time must come when equilibrium will at last be established. The nervous system will finally become capable of meeting, without being overcome, the difficulties of existence, and of supplying all usual demands. It will then cease to develop at the expense of the organism. By this very fact, fecundity will be normal, neither too great nor too little; and there will be harmony between the population and the conditions of existence. There is, then, truth in this final conclusion at which Mr. Spencer arrives: that the excess of fecundity has rendered the march of civilization inevitable (let us add the march of philanthropy), and the march of civilization should inevitably restore fecundity to its normal conditions. In this manner, perhaps, will be resolved the problem which troubled Malthus so much. In this way, also, we see that scientific philanthropy, by diffusing instruction along with well-being, and by raising the intellectual level of the needy classes, tends to establish among them the equilibrium of fecundity and of the intellectual functions, and consequently to diminish that blind and sometimes excessive proliferation which gives economists anxiety concerning the future, if not about the present. At this point, again, the advantages of philanthropy compensate, and more, for evils which involve nothing essential.

If it is important to establish in principle, as we have tried to do, the legitimacy and utility of philanthropy, it is not less necessary to fix the rules and limits of its application. An enlightened philanthropy should not bestow its benevolence at hazard and without conditions; it should be reparative and preventive justice together, instead of remaining that ancient "Christian charity" which, like love, too often

has a bandage over its eyes. Now, reparative justice should endeavor to re-establish the normal conditions of human association, of the "social contract." These normal conditions require that the contracting parties or associates be really free and major. Society, then, ought to see that all minority, all servitude, all excess of inequality that may be produced by the fatal effect of the laws of nature or of the social laws, is suppressed or alleviated as much as possible. That is the general rule which should first be laid down. We pass now to its principal applications.

In the first place, what are the best means which philanthropy, or rather justice, has at its disposal in regard to the disinherited of life? In our view, they are education and work, not the traditional alms. Education can not be anything but useful; it tends to the development of intelligence, and is an aid that raises up, not an aid that depresses. By education, instead of favoring the propagation of imbeciles, we prepare more and more intelligent and capable generations. The bearing of education extends to all kinds of servitude and want, but principally to intellectual servitude and want, which are the origin of all the other kinds. Ignorance of the things most essential to social life, and even to private life, is the worst state of minority. It exists by nature in all children; it is kept up by the lack of instruction among poor children, and persists in the grown-up man. The effort of the state should be brought to bear especially upon this point, for it is the point at which all kinds of justice, defensive, preservative, and reparative, as well as real fraternity or philanthropy, converge and agree. Instruction is a matter of duty and right as of all toward all, and from all points of view; but, to speak only of the duty of reparation, in what way can it be exercised to better advantage, more pacifically, more conformably to the true interests and real rights of all classes, than by distributing knowledge widely among all? Instruction is the universal instrument of labor, useful for all professions, adapting itself flexibly to the most varied employments, an instrument which in virtue of this very fact helps us to find new resources when the usual ones fail. This general instrument of labor ought to be gratuitous; it ought to constitute a kind of moral capital distributed by all to every one. Furthermore, instruction is the only public assistance, or, if that is better, the only indemnity, the only public reparation, in applying which we do not risk sacrificing the interest and health of future generations to those of existing ones. The second means at the service of an enlightened philanthropy is work, which of itself can not be anything but useful: labor elevates the character as instruction elevates the mind; by compelling those to work who are capable, by giving to the less well-endowed tasks proportioned to their capacity, we may be doing something to raise the moral level.

To whom ought the benefactions of philanthropy to be addressed, and within what limits ought they to be restricted? In the first place,

the child abandoned by its parents finds itself in one of those situations of major force and fatal servitude in which a member of society is incapable, unless he is assisted, of participating in the social life. In lifting up the orphan, society does not perform a work of mere charity, as those believe who speak of children brought up by charity; it simply performs a work of justice, not reparative only, but contractual justice. Shall we maintain that society has a right to let the foundling die, under the pretext that the support of children is the duty of the parents, and the parents are unknown? The most that can be said of such a conception is that it would be worthy of China and Japan. A society in the midst of which abandoned children may still be found is engaged toward such children by what the legists call a "quasi-contract"; it owes them food, with general and professional instruction, and in giving these to them it does nothing more than pay a general debt of reparative justice.* The same observation is applicable to the case of infirm old men, and, in general, of all persons who, being reduced to an absolute incapacity to work, have no parents who can support them; they also find themselves in a condition of minority and servitude which renders them incapable of taking care of themselves. A real moral right to assistance exists in these cases; in default of relatives, the duty of assistance falls upon the city; in default of the city, it falls upon the state; here is a point which legists, economists, and naturalists misconceive who see in public measures of relief an attempt on the liberty of individuals committed under the pretext of a charity that should be left free. Absolute liberty of charity is a religious and moral prejudice born of a defective analysis of rights.

Does society owe assistance only to those who are incapable of working, or does it owe it also to those who are capable but are exceptionally out of work, and thereby reduced to a condition of extreme misery—to a kind of temporary servitude and minority? The question is big with difficulties; it is one which has engendered too strong prepossessions to receive a scientific solution at the first view; and, between the contradictory exaggerations of the socialists and economists and the Darwinians, it still remains theoretically pending. We remark, in the beginning, that all countries, England, Germany, Sweden, etc., have recognized, whether right or wrong, a public duty to assist working-men. But they have not always taken the pains to limit the duty and give it a rational interpretation. The existence of the public duty of assistance can not confer upon the individual the right to demand work, either by force or by legal process. The state can not

* As much may be said of children "morally abandoned" and reduced to vagabondage. The public relief of the Seine, instead of shutting them up in a house of correction, from which they will come out corrupted, has, since 1881, placed them as apprentices in the departments. This measure needs to be completed by the passage of the bill for the protection of infancy, which was presented to the Senate on December 8, 1881.

engage itself, in a general and vague way, to give places or work to all who demand them, neither to the physician without patients, the advocate without causes, nor the poet without readers. It can no more make itself an ironmonger, a dealer in dress-goods, a furniture-manufacturer, or a house-decorator. In short, it can not substitute itself for the individual, artificially create work for him, nor artificially continue the production of any article, whenever a suspension reveals the fact that production has been excessive, and ought to be arrested. The merely moral right of the indigent engenders, in respect to this matter, only a moral duty on the part of society, a combined duty of reparative justice and fraternity. Since, moreover, the demands of every duty should be fulfilled, so far as is possible, society ought progressively to secure the satisfaction of them by the means which it shall judge best. But it can not grant its assistance to healthy individuals except under determined conditions and by a reciprocal convention. It is a case of a contract imposing mutual obligations, all the clauses of which ought to be settled with care. Here, more than anywhere else, the right to assistance is limited in a thousand ways, not only by the rights of personal property, but also by the real resources of the states, by practical impossibilities, and finally by the consequences that would follow if we should erect it into an absolute and positive right. It would in that case not stop short of self-destruction. We should recollect that, in the question of reciprocal rights and duties, we have to consider the future as well as the present. In this point of view, we can say in truth with the Malthusians and the Darwinians that the increase of sustenance would not follow the increase of population. As Malthus shows, an absurd consequence is implied in acknowledging an indefinite and unlimited right to assistance and to work; it is, that the funds destined to support labor can be made to grow at will, and that an order of government or a tax, like Elizabeth's tax, is all that is needed to bring this about. It would not be more unreasonable to order that two ears of corn shall grow where the earth has heretofore produced but one. Canute did not arrogate a greater power over the laws of nature when he prohibited the waves from touching his royal feet. To say that we ought to furnish work to all who only ask to work, is really to say, in other words, that the forces dedicated to labor, in any country, are infinite, that they are not subject to any variation, and that the ability to give work and good wages to the working classes ought to remain absolutely the same, without regard to whether the resources of the country are rapidly or slowly progressive, stationary, or retrograde.

This assertion, therefore, Malthus concludes, with reason, contradicts the most simple and most evident principles of the tender and the demand, and includes by implication the absurd proposition that a limited territory can feed an unlimited population. The question of assistance is inseparable from that of subsistence and population;

it is what we might call a bilateral question. The right to place children in the world is not a right merely individual and personal; there is in it an act that concerns not the parents alone, but all society as well. When the idle and careless call new beings into life, the task of feeding them falls back unjustly upon industrious and thrifty men. One does not have to take his children to the dispensary to put them in charge of society; the man who fills his house with children he can not support changes his house itself into a hospital, and that by his own authority, without consulting the convenience or considering the resources of any other one. The act involves an evident violation of stipulative justice. The state might, in such a case, say to the laborer: "You demand a promise of me, but are you disposed to give another one in exchange for it? My duty is correlative with your duty, and your right is not unconditional, but is subordinate to indispensable conditions. Will you give up the right of propagation? If you will, assistance is possible; if not, it is not, for you can not require those who have labored, produced, and saved, before you, to abstain from the enjoyment of the fruits of their labor till they have assured the support of all the beings whom it may be convenient for you or your descendants to call into existence." The procreation of children is not an act of individual whim, it is of the nature of a social act and of a contract. It is proper to have paternal and maternal duties determined by law. The false principle that every one has the right to procreate according to his fancy, without showing any more foresight than a brute, will eventually be rejected, says Stuart Mill, the same as the right of a merchant to buy and sell without keeping accounts is already rejected. To place children in the world without being able to support them will be regarded as a new kind of failure; it is, in fact, frequently more than a failure; it is a homicide by imprudence, because the children are destined to a certain misery and an almost certain death. All liberty involves responsibility.

Stuart Mill undoubtedly attaches too much importance to the legal regulation of population for the present time. In some countries, as in France, the population is now tending to diminish, rather than to increase too much. Furthermore, the bringing of American and Australian lands under cultivation assures subsistence to mankind for a long time, even if the population should increase rapidly. It nevertheless remains true that the relief given by the state can not be unlimited, and that assistance can not be erected into a right on which the individual can found a claim. Experience has shown us what kind of work we may look for out of the shops opened by public philanthropy. "When we do not give wages for work that we need," says Stuart Mill, "but give out work so as to furnish wages to those who need them, we may be sure that the work will not be worth what it costs." When we shall have no longer the power of dismissing the workmen, we shall not be able to get work except by the lash. Assist-

ance to working-men is, then, still only a moral and general duty of the state.

We can not enter here into the detail of the economical or political reforms which would render the giving of assistance more sure and more effective by removing the inconveniences (moral and physical) of what is properly called charity; we have only desired to show forth an ideal, and to give an apprehension of the difficulty no less than of the necessity of progressively attaining realization of it. The particular means by which the ideal is to be realized lie within the domain of applied sociology and politics. We merely indicate as among them the most perfect laws respecting property, the more equitable repartition of imposts, which should not be allowed to aggravate the *proletariat* by falling most heavily on the *proletaries* themselves; a better application of the imposts; the encouragement of institutions of credit, and of other means of credit less onerous than the *mons-de-piété;* the establishment of intelligence-offices for workmen seeking work; the extension of the system of mutual assurance on the initiative of the state and the communes, to a vast scale, in order to avert the most frequent and most grave material disasters; colonies, removal to which should be the natural destination of every healthy citizen who has no trade or profession, and who, by begging, or a vagabond life, puts himself under suspicion; and, lastly, the encouragement and increase of particular associations within the grand association of the state. Real benevolence is that which encourages, not idleness, improvidence, and the degeneration of the race, but labor, economy, and the moral and physical progress of generations.

"The state," says a writer who will be little suspected of socialism, M. Thiers, "ought to undertake to contrive means of preparation for panics. It may not be able to do all that could be asked of it, but with foresight it might do something, and even much, for the state has forts, machines, vessels, cordage, guns, cannons, wagons, harness, shoes, dresses, hats, cloth, linen, palaces, and churches to be made; and a competent administration, which would reserve these works, so varied, for the times of panic, which should have for some articles, such as machines, arms, wagons, and cloths, establishments capable of being extended or contracted at will; which should have designs for the strong places or the palaces it has to build prepared and kept ready for the seasons when the labors of private industry are suffering from interruption; which should thus gather up upon the general market the unemployed arms as speculators buy depreciated public securities, which should add financial foresight to an administrative foresight of this kind, and should keep its floating debt free and disengaged, so that it could find money when no one had any—an administration which should take upon itself all of these difficult but not impossible cases, would succeed in greatly reducing distress without, however, suppressing it entirely. . . . Do not assert, then, that we must let the

man without work die of hunger, for I contend that we can support him without giving him either wages equal to those of prosperous times, or wages that will allow him to become a mischief-maker or a soldier of the civil war."

The state concerns itself with the general interests of agriculture and commerce; with public works, the fine arts, posts, telegraphs, etc.; different ministries have been constituted for these ends; we believe there ought also to be a ministry of philanthropic institutions, charged with the duty of taking the initiative and creating foundations of this kind, with encouraging and aiding those that already exist, and with centralizing the efforts, gifts, and loans of individuals for philanthropic establishments. New organs should be provided, in the great body of the state, to answer to new needs. We now witness in this matter, especially in France, an absolute dispersion of forces, an anarchy, and faults in initiative and organization that impede all reform; if a special ministry existed for such questions, which seem not less important than those of the posts, commerce, and agriculture, the impulse would be quickly given. Loans, gifts, and legacies would permit the state to institute experiments under scientific methods or to aid those which might be made. Individuals do not, as a rule, care to bequeath their property to the state in general, for a general and neutral use; but how many persons would be glad to make gifts or legacies to philanthropic institutions! Religious congregations have a wonderful art of finding money for their works of benevolence; the state ought not to fold its arms and be indifferent as if it had no precise obligation in the matter. Foresight, public benevolence, and "fraternity," in our modern societies regulated by laws of increasing complexity, ought not to remain a kind of moral luxury wholly abandoned to the chances of individual inspiration. Charity is a general duty of justice, a work of science and not of mere sentiment, in which social economy and natural history ought to co-operate. In reality, the idea inspired by the labors of the Darwinian school on heredity and selection is, upon a final analysis, that of solidarity; and that is the very foundation of moral fraternity. Solidarity, doubtless, causes the miseries of one to fall upon the other members of the society, but it also extends the good fortune of each one to all and that of the mass to each one. By this very fact, it obliges society to find a remedy for every evil that afflicts the individual, because every such evil tends to become social. Solidarity limits our modern societies to the alternative of progress or dissolution. In the perfected machines which modern industry uses to weave linen, cotton, or wool, when a single thread breaks, the loom stops of itself, as if the whole had been informed of the accident that had befallen one of its parts, and could not continue its work till the breach is repaired. This is a type of the solidarity which is destined to reign more and more extensively in human society. In that social web in which all individual destinies intercross, it must come to pass

that not a thread can be broken, not an individual can suffer, without the general mechanism being informed of the accident, affected by it, and forced to repair the damage as much as possible. This is the ideal which philanthropy is pursuing, and which it will approach more closely as it becomes more scientific in its method, without ceasing to be also generous in its inspirations.—*Translated from the Revue des Deux Mondes.*

[*Concluded.*]

THE SCHOOLS OF MEDICINE.

By R. O. BEARD, M. D.

NOTHING is so popular as prejudice, and no prejudice so popular as that resting upon a supposed scientific basis, or backed by reputed scientific authority. Always obstructive to the spirit of progress, it is peculiarly so when related to a subject so closely concerning the interest of the people as the study and treatment of disease. In these physically degenerate days the avoidance or remedy of the thousand "ills which flesh is heir to" is a question of well-nigh universal import. The urgency of this common need offers a partial reason for the adoption and perpetuation, by the public mind, of the differences which are supposed to exist between the two great schools of medicine; while, at the same time, it measures the greatness of the misfortune of the fact.

Rooted in the professional ignorance and bigotry of almost a century ago, fostered by the bitter rivalries and exclusivism of opposing theorists, these differences have been taken up and fed by popular opinion, until they seriously embarrass the progress of medical knowledge, and tend to destroy all faith in the science and art of healing.

The medical fraternity at large, and of both schools alike, is responsible for this unfortunate condition of affairs. When professional men, who, supposably, represent the best phases of liberal thought and scientific culture, lend their names to the partisanship of mere theory, and array themselves under sectarian titles which signify their adherence to an exclusive dogma, it is small wonder that the laity should follow in their footsteps, and cast their views into the yet narrower mold of unreasoning prejudice.

And, as professional hands have sown this seed of error, it is they who must gather its barren harvest, and uproot the tares of false opinion from the popular mind.

The recent agitation within the ranks of the one school of medicine, of the question of establishing consulting relations with duly qualified members of the other, presents a good opportunity of offer-

ing to the general reader a few facts which may serve to illumine existing error, and prepare the way for the appreciation of some generally unrecognized truths.

It may be safely asserted that the chief obstacle which the profession has to encounter, in the attempt to harmonize the hitherto conflicting systems of medicine, is the existence of so violent a prejudice among the people in favor of one school or the other that the doctor's income is liable to suffer as an effect of any concession to his liberal convictions.

When an unknown physician appears in any community, and solicits a share of public patronage, what does the inquiring public first demand to know concerning him? Does society take the measure of his social standing, or estimate the quality of his moral character and training? Do his prospective patients seek evidence of his professional ability, his special acquirements, or his general scientific culture? No. They submit him to no such crucial tests as these. They content themselves with asking the one grave question, "Is he allopath or homœopath?" and, having reply, assign him, according to their prejudices, to an immediate place in their mental register, as possibly useful or probably imbecile. What important principle, then, lies back of this oft-repeated query to account for its unfailing repetition? What significance is attached to these opposing terms, and whence is it derived?

In the first place, the words "homœopathy" and "allopathy" have a common authorship. The great founder and apostle of the homœopathic school, Dr. Hahnemann, was responsible for their coinage and introduction to the public. With the one, he proposed to christen the creed which embodied his own peculiar tenets; by the other, to throw into sharp contrast the system of the older and established school.

It is worthy of remark that his followers have, until recently, accepted, with singular uniformity, their leader's distinctive term, while his opponents have always, and with few exceptions, repudiated the name thus contemptuously bestowed upon them, and which has fastened itself to them through the influence of popular usage. The definition of these terms is somewhat obscure. Homœopathy does not now possess, *in toto*, its original significance. In its earlier day it represented a *group* of dogmas, which most of its younger disciples disown. Infinitesimal dosage, increased potency by means of dynamization, the unification of disease, etc., have ceased to be *essential* planks in the homœopathic platform. According to more recent interpretation, it may be defined as a system of medicine based upon the one theory, "*similia similibus curantur*," or the doctrine of a similarity existing between the physiological and the curative action of drugs.

Allopathy, on the other hand, may be said to mean—in so far as it means anything—the application of medicine upon the principle "*con-*

There is no such thing as Allopathy in Regular Medicine.

traria contrariis curantur," or a system founded upon the belief in a certain antagonism discoverable between drug-action and disease.

Upon the face of these definitions, seemingly irreconcilable differences exist between the two leading schools of medicine; differences which, if borne out by the *facts* of to-day, furnish ample excuse for this persistently anxious query of the public. That the present status, however, of medical science affords no adequate support to this popular idea of a hopeless variance is clearly susceptible of proof.

When Hahnemann promulgated his new and remarkable dogmas, they certainly came into direct collision with the then accepted opinions and practice of the medical world. They were conceived and brought forth in an age of heroic measures in medicine; an age, too, in which the sthenic types of disease were largely predominant, and when the lancet and its auxiliary depletives were accounted the unfailing panaceas of all human ills in which failure was not a foreordained fact.

The homœopathic tenets rushed to the other extreme of theory, and, in practice, won the faint praise of doing at least no *injury* to human life. But, starting thus from widely separated points, the two schools have steadily traveled forward along paths set in inevitably convergent lines. The unbridged space which lay between them a century ago has been narrowed imperceptibly in their onward march, until men discover with surprise that to-day, across the intervening chasm, they can safely join their hands; and that, by mutual approaches, they may soon walk side by side, in common effort for the relief of humanity, and yet keep steadily "abreast of truth." Unconsciously receiving the impress of its opponent's teachings, the older school has learned, first, to *lessen*, and then to *minimize* its dose; to improve the preparation of its drugs, and to seek for better forms and methods in their administration. If it can boast the direct salvation of no greater number of lives, in consequence, it is at least responsible for fewer deaths. Its distinguishing characteristics have ever been an active spirit of investigation, and the consequent widening of the limits of its medical faith.

The homœopathy of to-day has also shaken from its feet the dust of more than one worthless theory. Although within its ranks are still numbered some so-called "high dilutionists," its leaders have long ceased to insist upon infinitesimal dosage as an essential principle of treatment. Not a few of its representative men administer many of their drugs in crude form, as the rule rather than the exception of practice. If it still clings to its central dogma, its principal adherents no longer claim for it the respect or merit of a *universal law*. That it serves as a good indication for the use of certain drugs, in the treatment of many conditions of disease, few careful students of materia medica and therapeutics will deny. Witness, as instances, the physiological as related to the curative action, in some particulars, of

arsenic, ipecacuanha, turpentine, nux vomica and its alkaloid, strychnia, and camphor. Explain the action in any way we choose—as substitutive, as the primary differing from the secondary effects of the drug, etc.—the relationship of similarity, however problematical its value, still remains.

Not seldom has the reproach been cast upon homœopathy that it possesses no literature worthy of the name; that its followers can boast no valuable discoveries or original research. In the main, the criticism is just. But, in this one department of medical science, the profession has received at its hands an incalculable benefit. It claims, and for the most part rightly, the credit of advancing, directly or indirectly, the study of the *physiological action* of drugs, as related to the alleviation and cure of disease. The careful experiments thus set on foot have thrown a light upon the selection and intelligent use of remedies which has largely revised the old system of therapeutics. Homœopathy has, undoubtedly, given to the world the revelation of more than one valuable truth, and the profession and people alike owe to it, in the persons of its advanced thinkers, the gratitude of respect and recognition. In short, as "every student is a debtor to his whole profession," so the schools of medicine are mutually beholden to each other. The same influences which have modified the one sect have served to liberalize both. The practical result, as already manifest, is of greater interest to the public than are the steps by which it has been reached. A careful study of the course of treatment commonly pursued by leading practitioners, and recommended by the highest authorities in the two schools, reveals the fact that, in *eighty* selected forms of disease, representing maladies of every type and every stage, six tenths of the remedies employed by these supposedly rival schools are identically the same in kind, and differ only in respect of dose. The variance is no greater than probably exists between the respective methods of practice of any two physicians of either school. Were disease an entity, and its types invariable, we might look for the establishment of a universal law of therapeutics; but, considering all the varying conditions of age, sex, temperament, habit, hereditary tendency, personal idiosyncrasy, climate, and general surroundings, it is, in the nature of things, impossible. Between homœopathic and "regular" physicians there is but one legitimate ground of quarrel—and herein the latter have sufficient cause of complaint—namely, the continuance, by their old-time opponents, of name and title suggestive of a rigid exclusivism, indicative of their supposed arrival at the *ultima Thule* of medical research, and their adherence to a universal dogma, to which, as such, they can no longer honestly adhere. Why should it not be possible for a guild of men, interested in so grand an object as the relief of suffering and the conservation of human life, to join cordial hands with their fellow-laborers in a common cause, and content themselves with the unequivocal name of *physician*, and the

honored and honorable title of *Doctors in Medicine?* Let this once be *un fait accompli*, and we may rest assured that the good sense and mutual interests of the two great schools will speedily draw them together, in a process of mutual absorption, which will give a new impetus to the *growth of medical science*, and contribute immeasurably to a more successful, because more rational, treatment of disease.

The New York State Medical Society, representing the head and front of the profession in this country, has recently taken an initiatory step in this direction, by striking out and changing certain clauses of its ethical code which prohibited consultation with duly qualified homœopathic practitioners. Despite the unfortunate action of the American Association, in setting the stamp of their useless disapprobation upon this timely step, a thinking public must needs declare itself in approval of the New York Society. It has but constituted itself the vanguard of a movement which will soon be followed by all liberal men in the profession, and must ere long sweep away those petty obstacles to the progress of medicine, which, causing the disunion of its disciples, have limited its usefulness, weakened its experimental conclusions, and brought upon it the popular reproach of disagreement.

Many, it may be, of the older generation of physicians—minds which have crystallized unchangeably to the form of early ideas—must "pass away before these things are fulfilled," but they who are stepping forward to take their places in the great struggle with disease and death, will have their hands strengthened by a more conscious unity of work and purpose with their fellows, to which the profession of medicine has long been a stranger.

The principal barrier, let me repeat, to the attainment of this desired end lies, not within professional lines, but in the existence of this unfortunate prejudice among the people. When patients demand to be assured that a medical practitioner is—not an "allopath" or a "homœopath," but—a reputable and well-educated *physician*, then will the folly of "exclusivism" be made manifest, not alone to the *mind*, but to the *pocket* of the profession; and then will Medicine, unembarrassed by the strife of schools, rise to her possible place as a successful and a more *exact science*.

BRAIN-POWER IN EDUCATION.

WE are supposed to live in an age when brute-force has ceased to rule, and when brain-power alone is the governing agent. In the good old days, the heavy, strong-armed knight, protected by his impenetrable armor, and skilled in the use of his sword, was almost invincible. A little nearer our own day, the skilled swordsman or

dead-shot whose ultimatum was the duel, ruled to a certain extent the society in which he moved. To test which was the most powerful knight was an easy matter; for a combat between the rivals was easily arranged, and the result was seldom questionable; or, if it were uncertain, the relative powers were supposed to be equal.

In the present day, however, the question of brain-power is a far more difficult problem. We can not weigh brains as we can tea or sugar; we can not determine their mental capacity as we could the physical powers of knights of old, by setting two of them opposite each other and leaving them to fight it out. We have, however, arranged various tests which we suppose give us a correct estimate of the brain-power of various individuals. These tests may be better than none at all, yet they are far from being perfect; consequently, we too often by such means select men to do work for which they are quite unsuited, and to fill offices for which they have no capacity.

The present is an age of competitive examinations, yet these afford but an imperfect test of brain-power; for, after a time, competitive examinations become less and less efficient as true tests of intelligence, and sink into a sort of official routine. As examples, we will take the following cases: Brown is the son of an Indian officer who died when his boy was ten years old, and left his widow badly off. Young Brown is intended for the Royal Military Academy, Woolwich; but his mother's means do not enable her to send him to a first-class "crammer's," so he has to sit beneath the average schoolmaster. He works hard and thinks a great deal, and gains a fair knowledge of the subjects he is required to learn. He goes up to the competitive examination at Woolwich, and finds each question so complicated that he is utterly puzzled; and, when the results of the examination are made known, Brown is nearly last on the list.

On the other hand, Smith is the son of a wealthy tradesman who wishes his son to enter as a cadet at Woolwich. Young Smith is sent early in life to a successful "crammer's," to be fattened with knowledge as turkeys are crammed for Christmas. The crammer does not confine his attention to teaching his pupils; but he watches the examination papers set at Woolwich, and he finds that the examiners have each a peculiar "fad," and set their questions in a sort of rotation. He looks carefully over these, and he forms a kind of estimate of the questions which are likely to be set at any particular examination. He therefore trains his pupils for these questions, and is often so successful in his predictions that at least half the questions have been worked out by these pupils a week before the examination; and this result is obtained without any collusion between the crammer and the examiner. On one occasion that we know of, seven questions out of a paper of thirteen were predicted as "due"; and the pupils consequently of this crammer were most successful at this "competitive." Young Smith is thus trained, and passes say fifth out of a long list,

and is considered, as far as this test is concerned, to possess brain-power far beyond that of the unfortunate Brown, who was nearly last in this same examination.

Twenty years elapse, and Smith and Brown meet. Smith has jogged on in the usual routine; he may have never either said or done a foolish thing. Brown, on the other hand, is a man of wide reputation, has written clever books, and done many clever things; yet people who know his early history say how strange it was that he was so stupid when he was young, for he was ignominiously "spun" at Woolwich!

Those who thus speak imagine that the examination at which Smith succeeded and Brown failed was a test of their brain-power. It was in reality nothing of the kind; it was merely a test of the relative experience of those who trained Smith and Brown.

Even thus far it will be evident that our present supposed tests are not infallible; but we will go even further, and will examine the actual work itself which is supposed to be the great test of mental capacity, and we can divide this work into two classes—namely, acquired knowledge, and the power to reason. In nearly every case, the training which enables a youth to pass a competitive examination belongs to the first class—acquired knowledge. It consists of a knowledge of mathematical rules and formulæ, classics, modern languages, history, and geography. Mathematics, if properly taught, and especially geometry, tends to strengthen the mind and fit it to reason; but it too often happens that a youth is crammed with mathematics for a particular examination, and he has not mentally digested what he has thus been crammed with; and consequently, instead of his mind having been strengthened by this process, it has in reality become weakened; and ten or fifteen years after the examination, the man—then in his maturity—derives no advantage from his formerly acquired knowledge, because he has forgotten it. He merely suffers from the mental repletion of his younger days, and dislikes mathematics; just as a pastry-cook's boy is said to abhor tarts and buns, because he was crammed with them when he first was placed among such temptations.

A knowledge of modern languages is useful to those who travel, or who wish to become acquainted with the literature of other countries; but, as a test of brain-power, the acquisition of any language fails. There is no language in use which is based on anything but arbitrary rules; reason has no influence on languages. The selection in French, for example, of masculines and feminines, is most unreasonable. Why should a chair in French be given petticoats, and a stool placed in breeches? Why should the sun be considered masculine, and the moon feminine? In German, the same arbitrary rules exist—the masculines, feminines, and neuters have no reason to guide them. Take a child of five years old, and a clever man of twenty-five—let each use only the same exertion to acquire a knowledge of any spoken language,

and the child will easily excel the man. This is because ear, and the memory derived from ear, are the means by which languages are acquired. Reason enables us to predict what is probable, when we know that which has previously occurred. If, then, we informed a reasoning individual that a chair, an article made of wood, with four legs, was feminine in French, and then called his attention to a stool, an article made of wood, with four legs, and inquired to what gender he considered the stool belonged, he would naturally conclude that it also was feminine; but a stool (*tabouret*) is masculine in French.

Then, again, the pronunciation of words is purely arbitrary. Take our own language, for example, and such words as plough, enough, cough, dough, bough, rough, etc. Where does reason enter into the pronunciation of such words? What power of intellect would enable us to pronounce "cough" correctly, even though we knew how "bough" was spoken? Yet, in spite of these unreasonable laws, classics and modern languages are not unusually referred to, not as stored knowledge, but as tests of mental power. As a rule, it is not the reasoner, or person gifted with great brain-power, who the most quickly learns a language, but the superficial thinker, gifted with ear; and these superficial people are the first to quiz any error made when a speaker attempts to converse in a foreign language.

We may fairly divide the subjects employed in modern mental training into those which store and those which strengthen the mind. Languages; a knowledge of history and geography; the *facts* connected with various sciences, such as chemistry, electricity, astronomy, etc., are stores; but not one of these does more than store the mind. Men's minds were stored with a certain number of astronomical facts when Galileo attempted to revive the olden belief that the earth rotated; but their minds had not been strengthened, as it was the leading astronomers who most offered opposition to him. Several men with stored minds were the great opponents of Stephenson when he talked about traveling twenty miles an hour on a railroad. So that it appears that, no matter how well a mind may be stored, if it is incapable of judging correctly on a novelty, it can not be called a strong mind.

Our competitive examinations tend almost entirely to bring to the front those whose minds are the best stored, and many persons therefore have come to the conclusion that by such a course we have obtained for our various services what are termed "the cleverest youths." It does not, however, follow that this result has been obtained. The greatest brain-power may actually be low down in the list of a competitive examination in which stored knowledge alone has been requisite. There is a certain advantage to be gained by storing the mind with facts, and some people imagine that a knowledge of these facts indicates an educated and strong mind. It, however, merely proves that the mind has been stored; it does not prove it to have been

strengthened. We may know what Cæsar did under certain conditions; how Alfred the Great organized his police so that he could hang bracelets of value on sign-posts without fearing that highwaymen would steal them; and a multitude of other similar facts may have been stored in our minds; but any quantity of such stores would not enable an individual to solve the present Irish difficulty, unless he could find in the past an exactly similar case which had been treated successfully by some particular system.

It is even now considered that by making a boy pass through a long course of mathematics or classics, and then testing his acquired knowledge by an examination, we adopt the best method of obtaining the greatest brain-power. We *may* derive an advantage, supposing mathematics or classics are requisite in the future career of the boy; but, as a test of brain-power and perseverance, we would much sooner select the boy who could the most rapidly and most certainly solve a three-move chess problem. And, if mathematics are not required in the future career of a boy, it would be equally as unreasonable to devote three years to the solution of chess problems as it is to devote a like period to the solution of the higher branches of mathematics. In both instances, the mental exercise is supposed to be for the purpose of strengthening the mind, and the chess problems are certainly as efficient as the mathematical. It is not unusual to find a profound mathematician who is particularly dull in all other subjects, and who fails to comprehend any simple truth which can not be presented to him in a mathematical form; and, as there are a multitude of truths which can not be treated mathematically, a mere mathematician has but a limited orbit.

A chess-player, again, or a solver of chess problems, has always to deal with pieces of a constant value; thus, the knight, bishop, pawn, etc., are of constant values, so that his combinations are not so very varied. A whist-player, however, has in each hand not only cards which vary in value according to what is trump, but, during the play of the hand, the cards themselves vary in value; thus, a ten may, after one round of a suit, become the best card in that suit. Brain-power independent of stored knowledge is therefore more called into action by a game of whist than it is by mathematics, chess, or classics; consequently, while mathematicians and classical scholars may be found in multitudes, a really first-class whist-player is a rarity; and, if we required an accurate test of relative brain-power, we should be far more likely to obtain correct results by an examination in whist than we should by an examination in mathematics. In the latter, cramming might supply the place of intelligence; in the former, no amount of cramming could guard against one tenth of the conditions. A first-rate mathematician may on other subjects be stupid; a first-class whist-player is rarely if ever stupid on original matters requiring judgment.

A very large amount of the elements of success consists in the advantages with which an individual may start in life, and over which he himself may have no control. The case of Smith and Brown already referred to may serve to illustrate this fact. When conclusions are arrived at relative to hereditary genius, these advantages may be considered. The son of a judge becomes a judge, and we may claim hereditary genius as the cause. We should, however, be scarcely justified in assuming hereditary genius because the son of a general officer became this general's aide-de-camp. A general officer with five thousand efficient troops gains a complete victory over fifteen thousand indifferently armed savages, and he is looked upon as a hero. Another general with a like number of men is defeated by an army of ten thousand well-armed but unsoldier-like-looking men, and he is regarded as a failure; and yet, of the two, the defeated army may have possessed the better general. In order, therefore, to judge of the relative powers of two individuals, we must take into consideration all the advantages or difficulties with which each starts in life, or in any undertaking. The relative success is by no means the only criterion from which to judge of capacity, any more than it would be correct to judge of the capacity of two whist-players, when one held four by honors and six trumps and his adversary held a necessarily poor hand.

In the great battle of life these conditions are perpetually interfering with the results to be derived from the relative value of brain-power, and are so numerous as to have an extensive influence. For example, a man possessing great brain-power has succeeded in attaining an official position of eminence. He selects a nephew or particular friend to be his assistant. We have competed with this assistant in various things, and there is no doubt as to his inferiority. Time goes on, and this assistant succeeds to the post of his relative merely from what may be called departmental claims, and he is *ex-officio* supposed to be possessed of the talents and knowledge which appertain to his post. Our opinion, if opposed to that of the official, will by the superficial outsiders be considered valueless; yet ours may be correct, and that of our opponent erroneous. It is by such means that very feeble men often occupy official scientific positions to which they are by no means entitled in consequence of their intelligence.

When such an event occurs, an immense amount of damage is done to the cause of truth and real science, because the individual thus raised by personal interest to the position of a scientific judge or referee, too often fails to judge of a question on its merits, and condemns it if it be not in accordance with routine. A question thus disposed of is very difficult to again bring into notice without prejudice. There is no doubt that even among the so-termed educated people, the majority possess only stored minds, and are incapable, consequently, of reasoning on any problem, other than by bringing to bear on it their stock of knowledge which, probably, granting the problem is original,

will not apply. No educated person doubts that the earth is a sphere; but few of these can prove that it is so by means of facts with which they are acquainted, though a simple law of geometry is able to prove the fact.

The average occupations of young men require nothing more than stored minds and powers of observation; consequently, our competitive examinations serve to some extent to bring to the front such qualifications. But it is not among such that we obtain our discoverers, inventors, great statesmen, or good generals. The mere routine man will almost invariably bring about a disaster when he has novel conditions to deal with; and as a rule the routine youth comes out best at an examination.

At the present time we have apparently no accurate test by which to measure the relative brain-power of individuals. Competitive examinations can not do so, for the reasons that we have stated. Success in life is, again, dependent on so many influences quite outside of the individual that this success is no test. The accumulation of money—that is "getting rich"—is too often but the results of selfishness and cruel bargains, and can not be invariably accepted as a proof of brain-power.

Considering these facts, therefore, it appears that just as intellect is invisible, so the relative power of intellect is unmeasurable; and instead of forming hasty conclusions as to the relative powers of two men, from the results of examinations, we may perceive that by such means we may be selecting those only who, under certain conditions, have succeeded in storing their minds with the facts required for that examination.—*Chambers's Journal.*

SKETCH OF HENRI MILNE-EDWARDS.

ON the 3d of April, 1881, a medal, bought with the subscriptions of the scientific men and friends of science of various nations, was presented to M. Henri Milne-Edwards by a committee of representative French men of science, in honor of the completion of his great work on "Comparative Physiology and Anatomy." This magnificent treatise—of which M. Blanchard, in making one of the presentation speeches, said: "Many authors have, with more or less of success, published treatises for those who were studying; M. Milne-Edwards alone has made one for masters"—was the fitting consummation to which nearly sixty years of scientific labor had consistently led.

M. MILNE-EDWARDS was born on the 23d of October, 1800, at Bruges, Belgium, of English parentage, his family having come from

Jamaica. After the invasion of Belgium, in 1814, the family removed to Paris, and established themselves there. M. Milne-Edwards studied medicine under the direction of his brother, William Edwards, author of a work on the influence of physical agents upon life, and afterward a member of the Institute, and was graduated as Bachelor in Letters in 1821, and Doctor of Medicine, at Paris, in 1823. In the latter year he presented several memoirs to the Academy of Sciences, among which was one on "The Influence of the Nervous System upon Digestion," which he prepared in conjunction with Breschet. In 1825 he published, in connection with Vavaseur, a "Manual of Materia Medica," of which a second edition appeared in 1828, and translations were made into English and German. His attention was afterward concentrated upon the zoölogical branches of science; and from this time on the history of his life is a record of his researches and his publications in those branches, the briefest satisfactory account of which would fill the space of an article.

In 1826 he began, with V. Audouin, a long series of researches on the anatomy, physiology, and zoölogy of the marine animals of the French coasts, for the purposes of which he, either alone, or with his co-laborers, made several sojourns at different points on the sea-shore. Between 1826 and 1830 he thus explored in succession the coasts of Granville, of the Chaussey Islands, of St. Malo, Noirmontiers, and collected the materials for his work on "The Littoral of France," in two volumes, one of which is devoted to the history of the Annelids, and was the subject of a long report by Cuvier. In the beginning of 1827 he presented to the Academy a memoir which he had prepared, in connection with M. Audouin, on the circulation of the blood in the Crustacea, which received the prize in Experimental Physiology. His "Manual of Surgical Anatomy," published in the same year, was translated into Dutch and English. During a few years following he was engaged much of his time in chemical investigations in the laboratory of M. Dumas, whose pleasure it was, in making one of the speeches on the presentation of the medal, to speak of himself as the oldest of his friends and the closest witness of the labors by which his life was made illustrious.

In 1832 he was appointed Professor of Natural History in the Collége Henri IV, and Professor of Public Hygiene and Natural History in the Central School of Arts and Manufactures. In the next year he prepared the zoölogical part of an elementary work on natural history, by himself and Achille Comte. In 1834 he published his "Elements of Zoölogy," an elementary book on zoölogy for lyceums, which is included, with a "Botany" by Jussieu and a "Mineralogy" by Beudant, in the "Elementary Course of Natural History," and a general work on the Crustacea, in three large volumes and an atlas, the last volume of which appeared in 1836. It was while he was engaged upon this work—"which has become classic, and has been the point of depart-

ure for all the studies in that grand division of the animal kingdom" —that M. Blanchard became acquainted with him, and it was of this period of his career that that friend said, in his presentation speech: "At that time much was said of your discoveries on the organization of marine animals, and of your researches on the littoral of France. . . . Generally, naturalists have studied marine animals in the cabinet; you were of the opinion that it would be better to observe them on their domain, in the actions of their life. The learned world applauded."

In 1834 he made a journey to Algeria, and on his return presented to the Academy several memoirs on the marine animals of the African coast, and also one on the changes in the color of the chameleon. His researches on the Polyps, the results of which were published in 1838, were begun at this time, and continued with the co-operation of M. J. Haime.

In 1839 he published a work on the Ascidians, prepared after investigations at St. Vaast la Hogue and Nice, and passed several months at Roscoff in making observations on the blood-circulation of the Annelids. In 1841 he published a special work on the Acalephs, Spermatophores, Cephalopods, and Eolidians. In 1844 he went to Sicily with MM. de Quatrefages and E. Blanchard, on a mission the scientific results of which were embodied in a work in three volumes, the first of which contained the account of his studies on the circulation of the mollusks. On his return from this journey, he was appointed a professor in the Faculty of Sciences in Paris, in place of M. E. Geoffroy Saint-Hilaire, in a position to which he had already been inducted as a substitute in 1838, while he had also been appointed Professor of Natural History in the Museum, in place of V. Audouin, in 1841. It is of this period that M. Blanchard said in his eulogy: "You became professor in the Museum, and found me assistant naturalist to the chair to which all the votes designated you. I have forgotten nothing of that time from which nearly forty years now separate us. One thought ruled you, dear master, that of giving a strong impetus to our science. You excited to research by your example; by your counsel, you indicated to young naturalists the ways they should pursue. Desiring to make explorations in the warm parts of the Mediterranean littoral, you took M. de Quatrefages and myself to Sicily. We returned from there with a harvest. You brought a new light to science: you showed for the first time how certain vital functions are performed when the organic apparatus are still in a condition of relative imperfection. You were able in a short time to furnish a thousand proofs that the sign of the highest perfection of organisms is given by the division of physiological labor. You were still young, Monsieur Milne-Edwards, but you were already saluted as a master and recognized as a chief. Witnesses of that epoch, now becoming a little rare among us, recollect how, everywhere that science was in honor, interest was taken in

the investigations on the organization of marine and inferior animals that were going on in our country. We had among us, in the course of a few years, the greater portion of the zoölogists, anatomists, and physiologists of the world. The first door at which they knocked was yours. At that fortunate period for science, your health was considered quite delicate. It has since appeared to all that your love for science gave you the strength which nature had refused you."

To these investigations succeeded his studies on the structure and classification of recent and fossil Polyps, and his monograph on British fossil corals, both prepared in connection with J. Haime (1848 to 1852), and in 1851 a series of memoirs on the morphology and classification of the Crustaceans (since collected in a volume of "Carcinological Miscellanies"). His "General Tendencies of Nature," which appeared in the same year, was on a subject which had occupied him for a long time; for his first publications on the vitality of the different parts of the animal organism, and on the law of the perfectionment of animated beings by the division of physiological labor, date from 1826, and were published in the "Classical Dictionary of Natural History." A monograph on the fossil Polyps of the Palæozoic formations, published also in 1851 in co-operation with M. J. Haime, forms nearly the whole of the fifth volume of the "Archives of the Museum." Between 1857 and 1860 he published his "Natural History of the Corals Proper," and in 1858 a large volume on the "Recent Progress of Zoölogy in France."

The crowning work of his life, the "Lessons on the Comparative Anatomy and Physiology of Man and Animals," was begun in 1857, and was completed on the publication of the fourteenth volume, of five hundred pages, in 1880. This work includes all the lectures which were delivered by the author at the Museum of Natural History during the twenty-three years that it was in preparation. Professor Michael Foster said of this work, the "beautiful legacy," as Bernard has called it, of the venerable author, reviewing the ninth volume in 1870, in "Nature": "At a time when a 'differentiation' of study is carried to such an extent that many physiologists know very little about other animals than frogs, rabbits, dogs, and men, and many zoölogists have a very meager acquaintance with the results of experimental physiology, such a work as this, which skillfully weaves together all the main facts of animal biology, is most wholesome reading."

M. Milne-Edwards was nominated an officer of the Legion of Honor in 1847, and a commander in the same order in 1861. He received the Copley medal of the British Royal Society in 1856, and the Boerhaave medal of the Scientific Society of the Netherlands in 1880, being the first person upon whom that medal had been conferred.

M. de Quatrefages, addressing the subject of this sketch on the occasion of the presentation of the medal to him in 1881, said: "We

present this medal to you in the name of the scientific men of the world. . . . All of us here recognize your merits; we all know why our appeal for homage to be given to you has been so widely answered. The first memoir you read to the Academy was in 1823. Since that time you have unceasingly continued to enlarge the field of science by your personal researches, and to teach, by speech or the pen, your rivals first, then the generations which grew up at your side. These labors, this teaching, then, have continued for nearly sixty years. And, to crown your work, you have collected into a single book the immense treasures of knowledge amassed by this long and noble labor. Your 'Lessons' present a complete picture of the past and present of the anatomical and physiological sciences, with their infinite details mebracing and co-ordinating general ideas, always as precise as elevated. The book marks a real epoch in the history of these sciences. It is from this time for us, it will be for our posterity, what the writings of Haller were for his contemporaries and for posterity. This is what even mere strangers to your habitual studies comprehend; and this is why we are authorized to present this medal to you in the name of the whole world."

M. Dumas said: "The Academy beholds in you the guardian of the noble traditions of the learned and the most authorized representative of French science. With passion for the truth, the boldness of a strong mind, and the prudence of a wise one, you have drawn a complete picture of life in all its aspects, as a consummate anatomist, as a sharp-sighted physiologist, as a physician, and as a skilled chemist. With you, physiology, in its highest and widest acceptation, has entered permanently into the study of the classification of beings. You have had the rare happiness, my dear friend, to begin young, to pursue in your maturity, and to terminate in the fullness of your vigor, a work which will remain a monument."

The list of his works, said M. Gaston Tissandier, in his notice of them in "La Nature," in May, 1881, "has not closed, for the eminent naturalist, in spite of his years, preserves all the ardor and activity of youth; without allowing himself rest, he consecrates all his efforts to scientific progress, offering one of the finest examples it is possible to cite of a magnificent career incessantly fertilized by labor and genius."

His son, M. A. Milne-Edwards, is pursuing the same course of research with the father, and displays in it the same characteristic activity and thoroughness.

CORRESPONDENCE.

THE BICYCLE CONTROVERSY IN STOCKBRIDGE.

Messrs. Editors:

ALTHOUGH the writer belongs to those inhabitants of the village of Stockbridge who are editorially stigmatized in the December number of your magazine as destitute of "moral backbone," as "openly immoral," and "barbarians," yet cowards and criminals have their rights at the bar of editorial as of other justice, and he asks you to permit him to file a plea to your indictment—in other words, to publish this answer to your strictures.

Sound criticism, quite as much as sound philosophy, you will agree, depends on a correct and complete statement of the facts. The following version of the bicycle controversy can be maintained by many witnesses. The writer asserts it to be in every material part substantially true.

The professor, whom you justly call distinguished, fresh from a victory in the Central Park of this city over the ladies, invalids, and children who had been accustomed to be pushed about the skating-rink on the sliding-chairs, which doubtless interfered with his essays in skating, and perhaps on abstruser matters, came to his country retreat in Stockbridge naturally confident of equal success in clearing out all bicycles from his path. He was accustomed to walk with his eyes downcast, *meditans nescio quid nugarum philosophicarum totus in illis*, and the necessity of keeping wide awake with his bodily eyes was annoying. There was no Park Commissioner and no "Century" or other social club where officials can be button-holed, and petitions granted *inter pocula;* but there were three selectmen, chosen to guard the interests of the town in the old fashioned New England way. He drew a petition, procured eighteen signatures, and presented it to them. Taking it as a fair indication of the sentiment of the town, the selectmen were on the point of granting it, when the application chanced to become known to one or two inhabitants who took a different view. A remonstrance was drawn, based on the facts that accidents more commonly occurred from bicycles frightening horses in the roadway than from permitting them on sidewalks; on the hardship of practically depriving children of all use of the bicycles; on the impolicy and injustice of subjecting summer fugitives from the cities to the same kind of restrictions they had fled from; and denying the existence or seriousness of the so-called accidents alleged in the petition. This remonstrance was signed by thirty-six persons. The signers were generally heads of families, and up to the moment of this act of turpitude were (with the exception of the present writer) persons of recognized standing and character. In consequence of this remonstrance, the selectmen decided to ignore the petition. The shrewd professor, then perceiving that though, by dint of that persistent persuasiveness in which he is unexcelled, he might collect signatures, yet that all the names remaining in the town could not outweigh the remonstrance, called on the person who prepared that paper and urged his assent to a second petition, which had already been signed by a considerable number of visitors and residents. This was a remarkable document. It began by renewing the prayer of the original petition; but the various signers had been permitted to incorporate in it their different views and prejudices, which gave it so motley an aspect that it was hard to determine what was the *net* application. It asked in one place that *all* bicycles be excluded from the sidewalks; in another, that they be so excluded excepting children's; in another, that bicycles exceeding thirty-six inches in diameter be so excluded; in another, that bells be required to be attached to all bicycles; and, in another, that no bicycle be allowed to go anywhere in the village faster than five miles an hour. The person of whom the request was made, though reiterating his opinion that the real and only serious danger of accidents in the village was from the frightening of horses in the road, yet being fond of peace, something of a "moral coward," and willing to see how a compromise would work, yielded to the professor's strenuous demand, and reluctantly signed a memorandum to the effect that he considered that the chief objection to an order excluding bicycles from the sidewalks would be removed by permitting children to ride them there. The multiform document, thus re-enforced, was thereupon taken to the other signers of the remonstrance, who, seeing the memorandum of their representative, signed also.

The wheels of the opposition being thus scotched, other signatures were then obtained, to the number no doubt correctly stated by your informant as a hundred and sixty-eight. Meantime, a moment's cool reflection out of the range of the professor's battery having convinced the first compromiser that he had made a mistake, he sent

a note to the professor, requesting that his name might be removed. When the note was received at the professor's house, he was out, busily engaged in getting signatures. The next day he called on the repentant signer and informed him that, before the note was received, the document had been already presented to the selectmen.

These selectmen, though I maintain just and well selected, were puzzled. After discussing in open session the question whether a thirty-eight-inch bicycle ridden by a small boy should be compelled to take to the road, while big boys on thirty-six-inch bicycles were allowed to patrol the sidewalks, and the difficulties of enforcing regulations depending on the exact size of the bicycle, they decided, as the wisest practical course, to exclude all bicycles, in accordance with the original, principal, and most definite purpose of the petition. This decision, we believe, was a perfectly honest one. There was, at any rate, enough to justify it as such, and the burden is on those who charge dishonesty to prove it. It is true, as alleged, that this order necessarily "caused irritation." Why? Because it was unjust, or appeared so to the village. Yet this indiscriminate exclusion was the real object at which the professor aimed, and which he partly gave up only in order to make sure of as much restriction as he could get.

But the order was not generally satisfactory, and a counter-petition (which your informant seems to have forgotten) was drawn up and at once signed by about *two hundred* of those who favored the cause of the bicycles. The list included a great majority of the substantial names of the village, and was handed in long before anything like a complete canvass could be made, because the chairman of the Board of Selectmen was to leave town the next morning for a considerable absence, and immediate action was necessary. The selectmen held another session. Horses were frightened daily under the eyes of all by bicycles on the road. No accidents known to the community at large had resulted from the bicycles on the sidewalks. The decision of the magistrates was a responsible one in a pecuniary sense, as they might entail on the town heavy damages as the result of forcing the bicycles into the road, to the distress and dismay of the riding and driving public. Still, prompted by the desire which they throughout showed to act cautiously and fairly on a controverted point with which they professed no personal acquaintance, they made, in accordance with the general sentiment, a modified and, as the event seemed to prove, a judicious order. They excluded the bicycles within certain designated limits from the central and business part of the village, where alone they thought accidents likely to occur, but permitted them elsewhere on the sidewalk. From extreme caution they proceeded tentatively, however. The order was made about the middle of August, to remain in force till the 1st of September. This was for the purpose of testing its practical operation before establishing a rule at the expiration of the time limited. No accident happened. Nothing happened which the lenses of the learned professor could magnify into an "accident"; and on the 1st of September the order was indefinitely continued, with the like beneficent result.

Now, the selectmen are charged with "playing into the hands of an active party in favor of the boys." We will not stop to inquire who was this active party which overawed the selectmen and commanded a majority of the votes. But is not it hard on the selectmen, who did what they conceived their duty in the manner described above, to charge them with knavery, without, so far as appears, other grounds than that the order they finally made, in view of all the facts, was unsatisfactory to the professor? This is not Spencerian doctrine. If it is what the editor of this magazine calls a "vigorous canon of scientific method," it is rather too vigorous.

In the article in the "Springfield Republican," the accusations (according to the writer's recollection) are more bitter, and one of the magistrates is attacked by name. We shall come presently to the charge of Stockbridge special amenableness to Mr. Spencer's indictment against the American people. But here we may inquire whether there is no other fault found by him with our people, to which those are amenable who publish accusations against official persons for which there is no scintilla of proof. Mr. Spencer's ethics prohibit slander and personalities.

Now let us glance at the more general facts:

It will be admitted that bicyclists, like other domestic animals, have some rights which, once defined, are as much entitled to protection as the wider liberty allowed pedestrians. The question to decide is, at what point the exercise of these rights begins to turn into a trespass. It will hardly be denied that in the open country bicyclists may leave the rough road for the more traversable path which runs by it, and when the road and the path lead into a small, straggling village, where pedestrians are rare, the practice is still clearly permissible. When the road and path lead into a larger village, the road becomes paved or macadamized, and the path becomes a sidewalk, the question changes its aspect. In villages like Stockbridge, where there is plenty of space, and the broad, graveled sidewalks are never crowded, it is not a simple one. A good bicyclist can guide his machine almost

around a blade of grass, and the great preponderance of accidents have resulted from bicycles encountering horses in the road. In large towns with thronged sidewalks, it is obvious that, whether bicycles are to be allowed in the road or not, they are in the way on the sidewalk, and ought not to be permitted there. A rule adapted to the compact English villages is not necessarily the best guide for ours. But it is not true that bicycles are not permitted on their sidewalks by any such general rule as the professor states. There, as here, the rule depends on the size of the village, and on the question whether such permission would or not be practically inconvenient. When the controversy in Stockbridge was going on, and rival posters were daily going up, considerable evidence was collected to this effect. In some villages, as in "Henley-on-Thames," the postmen travel altogether on bicycles, going freely on the sidewalks. In Massachusetts towns of about the size of Stockbridge, such as the neighboring villages of Lee and Barrington (which, by-the-way, are considerably larger than Stockbridge), and where there are no college professors, or, if there are, they reserve their perambulatory meditations for their return to their Poecilé, bicycles are generally permitted on the sidewalks. In much more populous towns, like Pittsfield and Springfield, they are doubtless excluded. Now, who is to decide when the permission to go on the sidewalk becomes a nuisance? Certainly, in this country, the people themselves, through their authorities. In New England these are the selectmen. New England almost if not quite alone retains the system of town self-government which for so many centuries preserved liberty and fostered civilization in Europe. The selectmen of a Berkshire village, charged with the supervision of the lives and property of the inhabitants, certainly have better means of judging and a stronger motive to judge rightly in what parts and places bicycles should be permitted within their jurisdiction, than a newspaper in Hampden County, or a magazine in New York City, acting on the *ex parte* statements of even a distinguished individual, who, having undertaken to have the question settled to suit himself, is indignant because the selectmen, in accordance with the expressed wish of a majority of those interested, have decided differently.

The writer is one of the professor's many admirers, and would be the last to impugn his good faith; but, once enlisted in a campaign, whether in behalf of science, charity, or some idiosyncrasy, he goes on with a persistency which is always indomitable and sometimes headlong; and he is apt to assume that his cause has but one side, which, in cases coming under the third of the above categories, at least, is not invariably true. In this instance, he threw aside the sketch-book with which it had been his wont to exercise his charming artistic talent during his vacation, and devoted his time to scouring and ransacking the by-ways and corners of the village for rumors and reports of accidents from bicycles, the existence of which, before they were seen or heard of by any one else, he was as satisfied of as Leverrier was of the existence of the planet Neptune before he saw it. He posted up from day to day notices of incidents more or less founded on fact, which he apotheosized into catastrophes. He went back over a period of four years, to the first introduction of the bicycle into the neighborhood, and the only genuine "accident" worth mentioning, it is believed, if his collection were dispassionately interpreted, was the result of the fall, on a baby-carriage, of a bicycle unskillfully mounted by a learner at this early day. People saw with wonder lists of tragedies posted in front of the post-office which no one had heard of, and which were the more mysterious as they were generally without date, and the sufferers were commonly designated as Mr., Mrs., or Miss Blank, or the infant child of Mr. and Mrs. Blank. Why had no one heard of these terrible things? Why were not half of us in mourning or in tears? What right had we to walk erect on unbroken legs while so many were mangled? It seemed as if a wholesale slaughter had been going on in the midst of us without our knowledge. Fortunately, a little inquiry into the facts soon dissipated our apprehensions.

Let me illustrate: the writer, while looking at the list of casualties with feelings fortunately for him not quite akin to those with which we used to devour the returns from the Chickahominy, read somewhat as follows (the number and the precise words are not remembered, but the substance of the bulletins is correctly given): "No. 16. The infant child of Mrs. Blank run over and badly injured by a bicycle. For particulars refer to J. O. R., Esq." Looking further the writer read as follows: "No. 21, J. O. R., Esq., run into and hurt by a bicycle." (J. O. R. was the same person referred to in No. 16.) It so happened that the writer observed at the moment in the post-office J. O. R., Esq., himself, and improved this opportunity by inquiring of him the particulars of the two calamities, calling his attention to the alarming record before us. "Well," said he at last, "that isn't exactly right. I didn't see anything happen to any child, and I haven't been run into myself, but I understood that old Mr. J. G. had been run into and hurt." Soon after this conversation, the writer chanced to meet the wife of the old gentleman in

question, and said to her he was very sorry to hear that her husband had been run into by a bicycle, and hoped it was nothing serious. "Why, no," said she, "he was not actually run into, but you know he is quite infirm, and a bicycle came very near him and he was a good deal alarmed lest it might hit him." This was the residuum from the analysis of the two accidents. A list of burlesque "*escapes*" was posted from day to day by the side of that of the so-called "*accidents*," and about equal credence was given to each. Both were worthy of "Patience," or the "*Belle Hélène*." To the annoyance of both parties, the selectmen at last impartially took down both sets of notices, not because of any improper motives as charged, but because of the crowd which gathered daily in front of the post-office so thickly as to become a nuisance. The professor was laughed out of court; and we villagers, while all conceding his excellence and genius, think him daft on the bicycle question. The real bullying was all done by him, though unconsciously; and the real "cowards" were those who, like the writer, under the glare of those wonderful eyes, had not dared to refuse to sign his pieced and patched compromise petition.

In sooth, this particular charge of moral cowardice in the Stockbridge people is unfounded and ridiculous. Not only were there no accidents deserving the name, but none were likely to occur on the sidewalk, which might not be avoided by that reasonable circumspection which the law expects from every one, and the want of which would precipitate a misfortune from a post or a wheelbarrow equally with a bicycle. The names attached to the bicycle-petition were signed because of the deliberate conviction that the danger from frightened horses was greater than from bicycles on the sidewalks. Horses in the country do not all get accustomed to these Centaur-like appearances, as those in the city do to corresponding monsters, such as the elevated trains, because different horses come into the village daily from the surrounding region. These animals standing on their hind legs, or rushing and shying, were frequent occurrences, whereas an unskilled bicycle-rider on the sidewalk can be avoided, and a skilled one can always avoid the pedestrian.

It is now, we hope, made apparent that Stockbridge barbarism has been prematurely assumed on *ex parte* testimony. Until a law should be passed to the contrary, the wide sidewalks away from the crowded part of the town were rightfully free to baby-carriages, children's wagons, wheelbarrows, and bicycles, and in the present state of the population there seem to have been good reasons why there should be no such law. At least, enough has been said to show that "the community" does *not* "acknowledge the outrage," and that the reason why the gentleman in question was "not supported but was condemned for his action" was, that it was reasonably regarded as an unwise and unnecessary attempt to curtail those rural privileges which citizens commorant in the country as well as the villagers themselves regard as a great charm of their summer.

Inaccurate "data" and the proposal of unnecessary legislation come strangely from the disciples of Herbert Spencer. Strange, too, would it be if they were nearer the "barbarism" of their master's code than the orderly lovers of freedom whom they denounce. "Infinite presumption is discernible in this attempt at regulating the doings of men by law. . . . The desire to command is essentially a barbarous desire" (Spencer's "Social Statics," pp. 321, 80).

The length of this communication may seem monstrous. But the writer has been long-suffering. As a lover of peace, he had allowed the printed circular distributed throughout the village, which contained the same one-sided version of facts on which your article is based, as well as the impertinent and libelous attack in the "Springfield Republican," to go unanswered. For the good fame of Stockbridge, at which the professor, while leaving it for some years, it is understood, as a residence, aims through the editor of "The Popular Science Monthly" this Parthian shot, I could hardly say less. But, unless some astonishing twisting or suppression of material facts compel a further statement, I shall not again ask permission to trespass on your interesting columns.

VERMICULUS OBTRITUS.

NEW YORK, *December* 22, 1882.

EDITOR'S TABLE.

MACHINE EDUCATION.

WE hear much of the bad effects of machine politics, but it is questionable if the evils of machine education are not far worse. By machine education, we mean the rigid, mechanical, law-established routine applied to great multitudes of children of all conceivable sorts who are got together in large establishments and sub-

mitted to operations that go under the name of mental cultivation. Machine education is of the very lowest sort, and the best that can be said of it is, that it is barely better than nothing at all. The worst difficulty is, that it is not capable of improvement. The method itself is radically false, so that the improvements of it but make it worse. At the same time it borrows influence from its enormous extension and the authority by which it is enforced. The education-factories run in series, each has a complex grading, and the different institutions are intimately belted with each other, and all driven by the motive power of legislation. As might be expected, the whole system is run with a view to popular effect, which is necessarily fatal to the best results.

If the reader will refresh his memory in regard to the first principles of mental cultivation by reading the article, found elsewhere in our pages, entitled "Brain-Power in Education," he will get a clear idea of what must be the necessary outcome of educational mechanics. In the work of the school there are two modes of dealing with the brain; it can be stored with information, or strengthened in its functional operations. True education consists in the development of brain-power in accordance with the laws of its activity, and is simply and always a discipline in spontaneous self-exertion. In the attainment of this object the engineer of the educational machine has very little to do. The office of the teacher is important, but it consists in encouraging, inciting, and arousing the pupil to put forth his own efforts, and when this is most effectually done the result is not of that conspicuous kind that is suitable to make a showy impression at a public parade. No method has yet been devised for exhibiting such results that is not full of rank injustice and that does not put a premium upon inferior work.

But it is wholly different when the object is simply to store the brain. This is an easy process, depending upon external appliances and mechanical arrangements, and is capable of being so organized and driven that a shallow and vicious system shall win the highest public applause. As the article referred to explains, it is impossible to get indexes of the hardest brain-work that are fitted to astonish gaping outsiders; but, when it is a question of merely stuffing with acquisitions, nothing is easier than to invent methods by which the results may be strikingly displayed. Hence the marking system which professes to indicate degrees of proficiency and educational results, and which gives so much business to teachers, examiners, inspectors, and superintendents, and enables them to report to boards of control, to parents, and to the public the wonderful success of the institution. This is machine education in its perfection, and the worst of it is, that it excludes the possibility of rational education. The two things are incompatible, for that which can be shown with effect is sure to take precedence of that which can not be exhibited, and brain-storing will proceed at the expense of the self-activity by which mental power is alone acquired. The subjects, moreover, that are most favorable to storing will take the lead and come to be fundamental in machine education. The whole mechanism of the public-school system is now impelled by law in this bad direction. The higher schools react upon the lower, to stimulate the method. Competition for promotion fires the vanity of the pupils, and parental influence conspires to heighten the result.

A new confirmation of this bad state of things has been recently elicited by the New York "Mail and Express," which has started a little inquest of its own into the working of the public schools. A reporter was sent to question the different teachers and officials on various points, and the information he

obtained is useful as illustrating the vigorous action of our educational machinery upon one hundred and twenty-five thousand pupils. The Superintendent of the Schools of New York said to the reporter:

"My assistants are instructed to visit the schools, and in their examinations to find out what the children know and how well they know it. *They examine in nothing but the branches prescribed by law to be taught, and in each grade only in the work allotted by law to that grade.*" Again he says: "In my last annual report you will find that, out of twenty-six hundred and ninety classes examined, eighteen hundred and twenty-seven were marked 'Excellent,' and eight hundred and nineteen 'Good,' and only forty-four as 'Not commendable.'" This is of course the kind of result that officials are interested in making, as it naturally brings public commendation, more ample appropriations, and larger salaries. By the very nature of the case, therefore, they will be disposed to favor all those injurious agencies which co-operate to heighten the effect. To illustrate how despotically this bad system works, and how completely all who act under it are but parts of it, listen again to the New York Superintendent: "It is my business to stand between teacher and examiner, principal and teacher, teacher and scholar, parent and teacher, and protect all in their rights. But as to permitting teachers or principals to dictate what questions shall be asked or how they shall be asked, and what marks shall be given—that would be equivalent to resigning my office and handing over the direction of the schools to them, something which I do not propose to do." Thus in machine education the dictation is of course official—those who are in closest relation with individual requirements being allowed no discretion.

President Hunter, of the Normal College, applauds the subjects and courses of study which lend themselves to the smooth working of the machinery by numerical percentage scales of proficiency, on which pupils are promoted from grade to grade, and from lower to higher institutions; but he does not deny that the marking system has some faults; he says: "That some of the pupils of the higher grammar-grades are overworked in preparing for the college, is undeniable; but the fault lies not in the course of study which the board has prescribed, nor in the methods pursued in working out that course, but in the ambition of parents to have their children rapidly advanced, and in the desire of the pupils themselves to obtain high marks."

But where, by the working of the great machine itself, the pupils are set to racing for the Normal College, and to racing for the College of the City of New York, what else can be expected? The honors are but a premium for overdriving in the direction of such acquisitions as make the best show in examination, and win the highest percentage of marks.

President Hunter also naïvely observes: "Many of the evils complained of in the present system would be remedied by allowing each teacher half an hour a day to show the pupils how to study." Verily, verily, the machine must be in perfection where this is impossible.

Mr. Commissioner Crawford admits that the New York schools were once quite imperfect, but that "now there are, generally speaking, no poor schools. There is a general uniformity of excellence. There is a greater unity, greater harmony, a higher level in teaching power. Then supervision was not so minute as at present. Now we have, perhaps, too much supervision, but the committee have endeavored in this report, and the superintendent is all the while trying, to ease up the machine." The ideal of education here implied, that of unity, uniformity, and harmony

in the external working of the system, shows how completely the State machine has superseded the older method by which the teachers had some liberty to adapt themselves to the fundamental though ever-varying requirements of individual pupils. It is the characteristic of machine education that in its working the individual disappears.

No doubt we are talking treason against the State, and blasphemy against a popular idol; nevertheless, there are many who hold that in education, as in politics, the sooner the machine is "smashed" the better. If practice in chess and whist would give a better education than the machine, it is time to protest. Our most thoughtful educators are revolting against the predominant method, which, having been adopted by the State as best suited for official management, is extending throughout the nation. But many, as we said, are striking out, and demanding a good deal more liberty in school management. They condemn the pernicious mechanics of the schools just in proportion to its perfection. Colonel Parker, for example, is one of those who demand more freedom in the play of educational agencies, and more attention to the kind of work that is least available for display. He is recently represented as saying that "uniformity in schools is death"; he does not believe in "per cents," he would not have them in schools under any circumstances: "Here is a child who is not so quick mentally as another; he studies as hard and labors as faithfully as the others, but, not being able to advance so rapidly, he is marked fifty per cent, while others walk off waving their ninety-five per cent in triumph. It is discouraging to the moderately dull child, and wrong. If a child is examined and asked the name of a river, and can not answer, off goes five per cent."

The difficulty of machine education is, that under it pupils are not taught to think for themselves. It can not educate the judgment, or prepare the mind to meet emergencies through the practice of self-reliance. As remarked by a teacher, "The public-school scholars are excellent in the line of their drill, but, take them one inch outside of it, and they are lost."

BICYCLES AND CIVILIZATION.

We give space to a long communication on the bicycle controversy at Stockbridge, replying to our article upon the subject two months ago. The writer makes many explanations, and indulges freely in sarcastic personalities; but the reader who cares to compare his letter with what we said will probably observe that the facts of the case remain substantially as we stated them, while everybody can judge as to the correctness of the conclusions drawn from them. To the local particulars of the Stockbridge war we can give no more attention, but will say a few further words on the general aspect of the subject.

We assumed in our former article that large bicycles run upon the sidewalks are objectionable. The sidewalks are a portion of the highway reserved for pedestrians, made smooth and hard to facilitate walking, and protected from exposure to accidents by street vehicles. A new wheeled vehicle is introduced of a peculiar character, but which belongs, if anywhere, to that part of the street which is usually devoted to vehicles. Thus far these new vehicles are only in a very small degree subservient to any use or necessity, public or private, but are run mainly for the pleasure of their riders. These are mostly boys seeking their amusement, and, as the machine is somewhat expensive, only a comparatively few boys are able to possess them. Probably there were not more than half a dozen boys with large bicycles in Stockbridge. They take to the sidewalk because they are ob-

jected to in the street, and because the wheeling is nicer. They run swiftly, and when under high motion can not be quickly stopped. That their movements are disagreeable to pedestrians is inevitable. They are sources of constant anxiety and apprehension to them. Accidents have occurred with them, and they are continually liable to occur. The sidewalk belongs to the community, and is indispensable to the daily uses and necessities of all classes of people. Everybody has the right to walk there without molestation or the apprehension of molestation. Nothing should be permitted there which will awaken the dread of danger and compel the pedestrian to be constantly on the lookout to protect himself. Our correspondent says that they can be easily avoided, but how can a bicycle coming noiselessly from behind be avoided? They have India-rubber tires, and people have no eyes in the backs of their heads. But it is by no means a question what people with their senses about them can do if they give all their attention to personal security. The instinct of self-preservation does, of course, save the mass of people from being run down by bicycles when exposed to them. But is it right to introduce an extra exposure of this kind on a public sidewalk that will keep the sense of personal solicitude against danger constantly uppermost in consciousness? Besides, all people are not vigilant in such matters; many are heedless and stupid, and others abstracted or absent-minded. Then, again, there are the children, the aged and infirm, the invalids, the deaf, the cripples, the blind, and the half-blind, and these constitute a very large proportion of those who use the sidewalks, and have a right to use them without annoyance. To all these people the large bicycles ridden by sporting boys are a constant source of fear and dread, a pest of the pathway, and an undoubted nuisance.

We are here speaking of the rights of pedestrians on a common-sense view of the case. But our correspondent says, "It will be admitted that bicyclists, like other domestic animals, have some rights, which, once defined, are as much entitled to protection as the wider liberty allowed pedestrians." Admitted, of course, the only question being on the definition. We have contended negatively that the riders of large bicycles have no right upon the sidewalks, any more than equestrians, but this is not a denial of all rights. What, then, do the bicyclists themselves maintain? They assert that the bicycle is a wheeled carriage, and its rights simply the common rights of carriages upon the street. The representatives of the bicycle associations in New York claim that their right is to the use of the highway, and they explicitly disclaim any right to the use of the sidewalk.

W. R. Pitman, captain of the Ixion Bicycle Club, on being asked his opinion as to the propriety of bicycles being ridden on the sidewalks of small villages, said emphatically that "bicycles had no business on sidewalks *anywhere;* that the sidewalks were meant for foot-passengers and not for carriages, which the bicyclers claim their machines to be."

Dr. N. M. Beckwith, captain of the Citizens' Bicycle Club, said that in his opinion bicyclers had no right to sidewalks at all, and remarked that the bicyclers wished to have their machines regarded as carriages, and claimed all the rights and privileges given to carriages, and in so doing they certainly could not also wish to be looked upon as foot-passengers.

Charles A. Reed, captain of the Columbia College Bicycle Club, said that he thought bicycles had no right on sidewalks or foot-paths except when the road was utterly impassable to them, and that a bicycle could certainly be ridden wherever a light buggy could be driven.

Extensive dealers have expressed themselves to similar effect. The Bicycle Union of Great Britain, in its recommendations regarding road-riding, said, "It is desirable that a rider should at all times keep to the left-hand side of the road, even if no vehicle be in sight, and riding on the footway should never be resorted to." (Pope's "Manual," p. 128.)

The circumstances in which it is admissible for bicycles to deviate into the foot-path are thus stated in "The American Bicycle," p. 122: "As to riding on foot-paths and sidewalks, it may be said that bicyclers, like travelers generally, have not only a right to travel in the highway, but they have a right to a passage along the highway, notwithstanding obstructions; and, if the middle of the road be impassable for their carriage, the side may be taken; and, if the whole roadway—including foot-paths — be impassable, they even have a right to turn out upon the abutting close, and pass over private land around the obstruction, provided they can do so without committing irreparable or very incommensurate damage. So that if, in suburban streets or country roads, the carriage-track is in so bad a condition as to be difficult or impossible of passage by a bicycle, and the foot-path can be taken without imminent risk to foot-passers at the time, it is justifiable for the bicycler to take it." The bicycle authorities are thus in full agreement with common sense.

And now about the impeachment of "the good name of Stockbridge." That lovely village, through its constituted authorities, and after due deliberation, decreed that such a nuisance as bicycles upon the sidewalks shall be tolerated. Is it not fair to take this fact as a measure of its moral status, and its grade in the scale of social progress? We were taught many years ago, in "Woodbridge's Geography," that communities of men are ranked as savage, barbarous, half-civilized, civilized, and enlightened. Any such classification is misleading which implies a stratification or a definite gradation of societies, so that one shall belong altogether at the bottom, and another at the top. The thing is much more mixed. There are savage streaks running through civilization, and enlightenment often coexists with barbarism. Society does not improve in all things alike. Every advanced community retains vestiges of its primitive lower condition. We gave Stockbridge credit for a large complement of virtues and excellences, but Stockbridge has proved herself to be no exception to the common law which gives rise to social anomalies. It has plenty of culture, intelligence, refinement, and religion; but, in common with many other highly cultivated communities, it betrays elements which are characteristic of the inferior grades of society. The ideal virtue of any community, its highest attainment, is justice. There is knowledge enough. People know well enough what is right, but in the undeveloped character conscience does not rule the actions. That is to be a matter of future evolution; and, meantime, we are concerned with the relative attainments of different societies in this respect. The sense of justice is so dull in Stockbridge that it is measured by the selfishness of a small group of boys. What those boys want for their personal gratification must be conceded, no matter what inconvenience to others stands in the way. What the standard of justice is among boys is pretty generally understood. The moral sentiments are the last to ripen in the growth of character, and the immature man has about him a good deal of the barbarian. Boys are thoughtless, selfish, uncompassionate, and often cruel. They delight to worry the cats, to stone the dogs, to plague their sisters, and fight each other. College practices and outbreaks often indicate the immaturity of youthful moral sense. The boys

taught the forms of civility, and that it is good manners to defer to others, but unless morally precocious they are not gentle men. That they should be indifferent at annoying and distressing people on the sidewalk with their bicycles is but natural. But as boys they are more than inconsiderate, and, if they did not run down old women, would enjoy scaring them. We, however, find little fault with the Stockbridge boys. But they need discipline in the recognition of mutual rights as well as indulgence for their pastimes, and the community which allows them to pursue their gratifications at the expense of the comfort of their neighbors is in that respect and to that degree—well—not in the highest degree civilized.

BAIN ON UNIVERSITY EDUCATION.

THE brief history of the higher education contained in the Rectoral Address of Dr. Bain at Aberdeen on "The University Ideal," which is herewith printed, will interest all thoughtful readers. It will prove chiefly interesting as a compact review of changing university methods during the rise of modern knowledge, and a statement of the present status of the university in the exigencies of modern life. As regards modes of teaching, the type of the university which has grown up within the last hundred years is based upon the principle of the division of labor by which men specially qualified for the work are especially intrusted with the subjects they have mastered. Obvious as this principle is to us, and difficult as it is for us to conceive how the higher education could stand upon any other principle, yet the present method is but the product of centuries of struggle before this policy could be established. It is undoubtedly a result of that general progress of science which can not be said to have got its initiation in the older university methods. With the division of labor in teaching comes the new aim of the higher schools of learning. "Its watchword is progress, and there can not be progress without a sincere and single eye to the truth. The fatal sterility of the middle ages, and of our first and second university periods, had to do with the mistake of gagging men's mouths and dictating all their conclusions. Things came to be so arranged that contradictory views ran side by side like opposing electric currents, the thick wrappage of ingenious phraseology arresting the destructive discharge. There was, indeed, an elaborate and pretentious logic supplied by Aristotle and emended Bacon; what was still wanted was a taste of the logic of freedom."

Dr. Bain insists that the bearing of modern science upon the higher education creates the demand for three fundamental elements in any adequate university curriculum, and he maintains that Aberdeen University holds the leading place in having recognized these elements for the past hundred years. He says: "Our curriculum is one of the completest in the country, or perhaps anywhere. By the happy thought of the Senatus of Marischal College, in 1753, you have a fundamental class not existing in the other colleges. You have a fair representation of the three great lines of science—the abstract, the experimental, and the classifying. When it is a general education that you are thinking of, every scheme of option is imperfect that does not provide for such three-sided cultivation of our reasoning powers. A larger quantity of one will no more serve for the absence of the rest than a double covering of one part of the body will enable another part to be left bare."

LITERARY NOTICES.

RAGNAROK: THE AGE OF FIRE AND GRAVEL. By IGNATIUS DONNELLY, author of "Atlantis: the Antediluvian World." Illustrated. D. Appleton & Co. Pp. 452. Price, $2.

THIS must rank, we suppose, as a book of science, though it is of a quite peculiar kind. It is something like what one of Jules Verne's books would be if that author should stoutly protest that the story was all true. The author put forth a work not long since, entitled "Atlantis: the Antediluvian World," in which he maintained that there is a good deal more truth than poetry about the old story of the fabled island. The book was readable and popular; and, encouraged by its success, he has now struck out more boldly, and given us in "Ragnarok" perhaps the most stunning and stupendous romance of science that has ever been perpetrated.

Opinions will be divided as to whether the author is practicing upon public credulity by an enormous joke, or whether he does not really himself half believe half that he says. He is probably a lawyer, and at all events a politician; and it would, therefore, not be fair to him to raise any question of the sincerity of his views. Nor is it at all important how this point is regarded by the reader, for this is just the peculiar kind of science that escapes all perplexing and stupid inquiry about its truth.

The work is geological, astronomic, and religious, because it falls back upon these three subjects for the materials of the author's theory. This theory has two aspects, a negative and critical, and a positive and constructive aspect. It first maintains that the loose materials of the earth's surface—gravel, pebbles, stones, sand, clay, bowlders, and the miscellaneous mineral stuff which makes up the drift or diluvial deposits upon the earth's surface—are not derived from the rocks that make up the earth's crust, as taught by geology. The author has read over all the geological treatises and speculations on the origin of these superficial formations, and devotes his first eight chapters to a very ingenious presentation of the insufficiency of all existing theories upon the subject. Evidently knowing little about it himself, in the real sense of *knowing* (that is, as a first-hand observer of facts), and addressing an audience in a quite similar state of mind, he has no difficulty in making out a wonderfully plausible case. If the experts in "evidence" can often convict innocent men and get scoundrels acquitted in the very teeth of opposing representations, it is easy to get up a telling case where there are many gaps and discrepancies in our knowledge of a new, extensive, and very complex subject.

Having thus impeached the geologists, our author has a clear field. If the loose mineral materials under our feet are not from the rocks, then pray where do they come from? The human intellect can not stand still, as if struck with paralysis, and wait forever for the geologists to settle their disputes; we must have an answer, and be at peace. Mr. Donnelly then proceeds to supply the answer. He here strikes off into astronomy, and maintains that this mineral *débris* is of meteoric origin. Stones are known to fall from the heavens, and spectrum analysis proves that the celestial bodies are composed of the same mineral constituents that are found upon the earth. There being, as old Kepler says, more comets in the heavens than fishes in the sea, and their movements being so apparently capricious and irregular that they dash about through the solar system with the greatest liability of striking its steady-going members, it is maintained that the earthly drift has been dropped upon this globe by one of these incontinent wanderers, as, perhaps, the earth went through its tail.

The author propounds this idea as an hypothesis, insufficient it may be at first blush, but admissible when all others have broken down. But he does not by any means leave the question in this speculative condition; he proceeds to summon the proofs that his hypothesis must take rank among great scientific truths. For this purpose he enters the vast field of legendary lore, and shows by the myths, traditions, fables, allegories, and obscure imaginative inventions of all peoples and nations, that something prodigious once happened to this globe, which he claims was nothing else than the deposit of the drift formation

which the geologists are so much troubled about. The Greek, Roman, Egyptian, Indian, Arabian, and Aztec theogonies are learnedly ransacked for the evidence they afford to the truth of the new theory. Thirty-nine pages are given to sifting the testimony of Job, who seems to have had a very luminous forecast of Mr. Donnelly's great discovery, and wrote as if he were happy in the idea that he might be permitted to contribute something to it. Then we have twenty-four pages of instructive exegesis, entitled "Genesis read by the Light of the Comet," and at the close of this chapter the author invites attention to the full accordance of the Biblical, Druidical, Hindoo, and Scandinavian legends in confirming "the great unwritten theory that underlies all our religion." The fundamental ideas which underlie the underlying theory of our religion are thus enumerated: "1. The golden age; the paradise. 2. The universal moral degeneracy of mankind; the age of crime and violence. 3. God's vengeance. 4. The serpent; the fire from heaven. 5. The cave-life and the darkness. 6. The cold; the struggle to live. 7. The 'fall of man,' from virtue to vice; from plenty to poverty; from civilization to barbarism; from the tertiary to the drift; from Eden to the gravel. 8. Reconstruction and regeneration."

All the religions of the world being thus levied upon for proofs of the author's theory, and our own being found so eminently tributary to it, we are entitled to say that this is not only a peculiarly scientific book, but also a peculiarly religious book. He certainly makes a good deal of "matter," but he lets us know that he is no "materialist." Be assured, says he, "be assured of one thing—this world tends now to a deification of matter." But we can not heartily commend that combination of waggishness and piety which is but too obvious in a passage like this from his farewell chapter:

> Do not count too much, Dives, on your lands and houses and parchments; your guns and cannon and laws; your insurance companies and your governments. There may be even now one coming from beyond Arcturus or Aldebaran, or Coma Berenices, with glowing countenance and horrid hair and millions of tons of *débris*, to overwhelm you and your possessions, and your corporations and all the ant-like devices of man, in one common ruin.

Again:

> Build a little broader, Dives. Establish spiritual relations. Matter is not everything. You do not deal in certainties. You are but a vitalized speck, filled with a fraction of God's delegated intelligence, crawling over an egg-shell filled with fire, whirling madly through infinite space, a target for the bombs of the universe.

It is to be hoped that Dives will heed these appalling admonitions.

On the whole, "Ragnarok" is too absurd to do much mischief, and contains much that is readable, and that may in a certain way prove instructive; that is, it may serve to kindle an interest in some minds upon subjects to which they would not be attracted by ordinary didactic treatises.

ZOÖLOGICAL SKETCHES. A Contribution to the Out-door Study of Natural History. By FELIX L. OSWALD, author of "Summerland Sketches of Mexico and Central America." Philadelphia: J. B. Lippincott & Co. Pp. 266, with 36 Illustrations. Price, $2.

IT is unnecessary to commend to the readers of "The Popular Science Monthly" the writings of Dr. Oswald, but we must keep them informed of what he is doing. His last volume of "Zoölogical Sketches" is undoubtedly the most entertaining of his publications. We know of no delineator of animal traits who has so entered into the spirit of that lowlier order of beings that have hitherto been so contemned, misunderstood, and outraged. For perhaps in nothing has the brutality of man been so exemplified as in his treatment of what he calls the "brutes." No doubt, a kinder feeling is beginning to grow up as his kinship with those below him is better understood; and as men are beginning through the rise of an intelligent sympathy to oppress and abuse each other less, their humble and more defenseless relatives are certain to share some of the results of this human amelioration. Such works as this of Dr. Oswald will do much to strengthen these kindlier sentiments toward the animal creation. There is an exquisite good humor, a lively wit, and a joyous exuberance of feeling in Dr. Oswald's descriptions of the life of our inferior relatives in which nature has not yet been perverted.

The learning of this author in the field

of natural history is extensive. We refer not so much to the scientific knowledge of the animal kingdom, its relationships and classifications, as to the knowledge of the ways, habits, instincts, and curious performances of the higher grades of the animate tribes. And this knowledge is by no means of the second-hand order so characteristic of popular books on natural history. Dr. Oswald has been an indefatigable observer of animal habits, of widely extended opportunity in various countries, and with a passion for what we may call companionship with inferior creatures. There is more of novelty, freshness, and out-of-the-way incident connected with the author's experience in this volume than in any other we have lately seen. The admirable woodcuts, no doubt, give effect to many of the curious situations, but the writer's text is pictorial, and vividly images what the limner can not represent. We have undertaken to make some selections, but choice is difficult where you can find nothing better than all the rest. The chapters on "Our Four-handed Relatives," "Sacred Baboons," "Animal Renegades," "Pets," "Secretiveness," "Traps," and "Four-footed Prize-fighters," are especially rich, but the others are hardly less interesting. The book is to be commended not only for its instructiveness as a higher study of natural history, but for its humanizing spirit, its sympathetic insight into animal characteristics, and its vivid and pleasing style.

There is a very considerable unity in Dr. Oswald's various writings. They are animated by a common feeling, and pervaded by the same fundamental ideas. Dr. Oswald is a passionate lover of nature. In his interesting book upon Mexico, the brightness and fervor of his pictures of natural scenery betray the poetical tendencies of his mind, which rejoices in communion with all that is beautiful, picturesque, wild, and sublime in mountains, plateaus, and valleys that have not yet been desecrated and desolated by the hand of man. He holds that "the children of Nature have not lost their earthly paradise"; it is only those that have turned away from her that have fallen. In his book on "Physical Education," there is an earnest pleading for a return to Nature on the part of those who have wandered away into misleading courses under the guidance of false ideas. There is something of sadness in the impatient denunciation and stinging invective of Dr. Oswald's writing, when he speaks of the anti-natural apostasy which has entailed so many evils on mankind. Even in the preface to the present volume, he returns to this subject as giving a clew to the spirit in which it has been written, and the presentation is so characteristic that our readers will thank us for giving the extract entire:

> The tendencies of our realistic civilization make it evident that the study of natural science is destined to supersede the mystic scholasticism of the middle ages, and I believe that the standards of entertaining literature will undergo a corresponding change. The Spirit of Naturalism has awakened from its long slumber.
>
> A year after the birth of the Emperor Tiberius, says Plutarch, a Grecian trading-vessel sailed along the coast of Ætolia in the Gulf of Patras, and when the sun went down the crew assembled at the helm to while away the night with songs and stories. The night was calm, and some of the sailors had already fallen asleep, when they heard from the coast a loud voice calling the name of their steersman, Thamus. They were all struck dumb with amazement, but at the third call, Thamus manned himself, and answered with a loud mariner's shout.
>
> "O Thamus," the voice called again, "when you reach the heights of Palodes announce that the great Pan is dead!"
>
> Four hours later, when the moonlit hills of Palodes hove in sight, Thamus complied with the strange request, and, a minute after, the coast resounded with indescribable shrieks and lamentations that continued for a long time, till they finally died away in the heights of the Acarnanian Mountains.
>
> The tradition bears the mark of that suggestiveness which distinguishes a philosophical allegory from a priest legend. Pan was the God of Nature. Can Plutarch have divined the significance of the impending change? Whatever is natural is wrong, was the keystone dogma of the mediæval school-men. The naturalism of antiquity was crushed by supernatural and anti-natural dogmas. The worship of joy yielded to a worship of sorrow, the study of living nature to the study of dead languages and barren sophisms. Literature became a farrago of ghost-stories, monks' legends, witchcraft and miracle traditions, and astrological vagaries. The poison of anti-naturalism tainted every science and every art, and perverted the very instincts of the human mind. Painters vied in the representation of revolting tortures. The exiles of Mount Parnassus assembled on Mount Golgotha. The moralists that had suppressed the Olympic festivals compensated the public with *autos-da-*

fit. The whole history of the middle ages is, indeed, the history of a long war against Nature.

But Nature has at last prevailed. Delusions are clouds, and the storm of the Thirty Years' War has cleared our sky. The real secret of the astounding success of modern science and industry is a general *renaissance* of naturalism, and the same revival begins to manifest its influence in the tendencies of modern literature. Ghost-stories are going out of fashion. Like scrofula and other bequests of the middle ages, the sickly pessimism of the sentimental school is yielding to the influence of a revived taste for the pleasures of out-door life. Books of travel, of sports and adventure, historical, zoological, and even biological and cosmological studies, are fast superseding the historical romances of the last generation. Even the pariahs of our reading-rooms have advanced from ghost-hunts to scalp hunts, from impossibilities to improbabilities. And, moreover, the progress of natural science tends to supersede fiction by making it superfluous—even for romantic purposes. There is more romance in the travels of Humboldt, more magic in the idyls of Thoreau and the revelations of Darwin and Haeckel, than in all the fancies of the mediæval miracle-mongers. The wonders of nature begin to eclipse the wonders of supernaturalism. A Zoölogical Garden attracts more sight-seers than the best Passion-play. Pan has revived.

The plan of the present volume is modest enough: its theories are mere suggestions; its limits have often obliged me to reduce a chapter of zoölogical adventures to a page of zoölogical anecdotes. But, in offering it as a contribution to the entertaining literature of the English language, my diffidence arises from a distrust in my own abilities rather than from the deficient interest of the subject itself, for the history of that literature has repeatedly proved that natural science can be made more attractive than the products of fiction or mysticism—by just as much as the resources of Nature exceed the resources of her rivals.

THE COUES CHECK LIST OF NORTH AMERICAN BIRDS. Second edition, revised to date. With a Dictionary of the Etymology, Orthography, and Orthoëpy of the Scientific Names. Boston: Estes & Lauriat. Pp. 165.

THE first edition of the "Check List" was published in 1874, and was a bare catalogue of the scientific and vernacular names. It contained seven hundred and seventy-eight names of species and sub-species, and was prepared with a degree of accuracy that is exhibited by the fact that it has been found necessary in the revision to remove only ten names of duplicates or extra-limital species, while a hundred and twenty names have been added. The large majority of the additions are *bona fide* species, and actual acquisitions to the North American list—birds discovered since 1873 in Texas, Arizona, and Alaska, together with several long known to inhabit Greenland. Except in Mr. Ridgway's National Museum catalogue, which was published after Mr. Coues's list was written, the full list of Greenland birds has never before been incorporated with the North American list. The field of North American fauna is generally bounded by the northern boundary of Mexico. The objection is made that this is a political rather than a scientific limit; and Mr. Coues suggests that it would be more exact to extend the limit, along the highlands at least, to about the Tropic of Cancer. In revising the list, particular attention has been paid to the matter of nomenclature, not only as a part of scientific classification, but also as an affair of writing and speaking the names of birds correctly; and the work includes, besides the list of the names, a full and scholarly treatise on the etymology, orthography, and orthoëpy of all the scientific and many of the vernacular words employed in the nomenclature, the work in great part of Mrs. S. Olivia Weston-Aiken.

NEW CHECK-LIST OF NORTH AMERICAN MOTHS. By AUGUST R. GROTE, President of the New York Entomological Club. Pp. 75. Price, $1.

THIS list contains about four thousand names of species, synonyms, and varieties of the North American Sphingidæ, Bombycidæ, Ægeriadæ, Thyridæ, Noctuidæ, Geometridæ, Pyralidæ and Tortricidæ. It will be welcome and useful to the student and collector of the interesting insects which it enumerates. The list embraces all recent discoveries and replaces the former catalogues of the author, as it takes in all the species. It also contains some of the results of a partial re-examination of the British Museum collections made by Mr. Grote last winter, and it includes the Tortricidæ published by Lord Walsingham, and Professor Fernald's recent arrangement of that family. It is well printed, on good paper, uniform in style, with "Papilio," the journal of the New York Entomological Club, and it may be had of the secretary of the club, Mr. Henry Edwards, No. 185 East One Hundred and Sixteenth Street.

HOUSE-DRAINAGE AND SANITARY PLUMBING. Providence: E. L. Freeman & Co.—ANLAGEN VON HAUSENTWASSERUNGEN NACH STUDIEN AMERICANISCHER VERHÄLTNISSE. (Plans for House-Drainage, after Studies of American Arrangements.) Berlin.—DIAGRAM FOR SEWER CALCULATIONS. All by WILLIAM PAUL GERHARD, Civil and Sanitary Engineer. Newport, Rhode Island. Pp. 105, 38, and 7. With Plates.

THE first of these publications is a reprint of a paper which was contributed to the fourth annual report of the State Board of Health of Rhode Island, and is an excellent practical treatise on the subject considered. It asserts the possibility of securing an efficient and healthful drainage of houses, whether upon open ground or into a sewer or cess-pool, by methods which are without mystery or secrecy, and involve "nothing more than the proper application of well-known laws of nature"; and explains specifically and with intelligible illustrations the best systems of drains, pipes, traps, basins, bath-tubs, water-closets, and sinks, at the same time pointing out the errors and defects of many of the systems in use. The second work is intended to give to German engineers a description of house-drainage as it is practiced in England and the United States. The third pamphlet is a description of a diagram on sewer calculations constructed by the author, and is of technical value. The first of these publications, revised by the author, is now published by D. Van Nostrand as No. 63 of his "Science Series." Pp. 205. Price, 50 cents.

NEW METHOD OF LEARNING THE FRENCH LANGUAGE. By F. BERGER. New York: D. Appleton & Co. Pp. 138. Price, $1.

THE author a few years ago published a "Method" for French pupils learning English, which has been used in France satisfactorily, and with a success that is represented by the exhaustion of fourteen editions of it and a fourfold increase of the number of French students of English in five years. He now applies the features that characterize that system to the study of the French language by English pupils. The features are a simple and careful indication of the pronunciation, and a conversational method, in which are given—1. The French text, with the pronunciation and a literal translation; 2. A review of words; and, 3. The French text again, with the English opposite, translated closely, so as to enable the pupil to translate alternately into French and into English. Besides the lessons on this plan are given conversational phrases, paradigms of the verbs *être* and *avoir*, conversational phrases, a version of Miss Edgeworth's play of "Old Poz," and a collection of words, sentences, phrases, and idioms.

CHAPTERS ON EVOLUTION. By ANDREW WILSON, Ph. D., F. R. S. E., etc. With 259 Illustrations. New York: G. P. Putnam's Sons. Pp. 383. Price, $2.50.

WE have no hesitation in cordially recognizing this volume as a timely contribution to a subject that is now attracting wide and serious attention. It meets an undoubted want, and is certain to prove helpful to all general students of the subject of organic development.

Yet, the title of the book may be objected to as somewhat misleading. It is not devoted to evolution in the full meaning now given to that term, but is restricted to one division of it, which ought to have been designated in the title. It is more properly confined to that phase or section of evolution which has come to be represented by the term "Darwinism," and is a book that should be ranked with Professor Gray's "Darwiniana" and Oscar Schmidt's German volume on "Descent and Darwinism." There should be no confusion here, for Darwinism is not evolution, and is but a part of it. Dr. Wilson virtually concedes this by employing in his text the term "Darwinian evolution," thus recognizing that it is but one sort of something of a larger kind; and also when he speaks of "development" as a strong pillar of the theory of evolution.

With the reservation here made, Dr. Wilson's work, as we have said, may be heartily commended. It is a very full and popular treatise on the important and interesting questions of organic development, and abounds in the biological information that has now been accumulated in illustration of the law of descent with variation. The principle of natural selection is, of course, assumed and interpreted as a great contribution to organic progress, and the various questions that have arisen in connection

with the development of the organic kingdom are considered with fullness, and by a naturalist competent to deal with them. In his preface the author observes: "A considerable experience as a biological teacher has long since convinced me that the hesitancy with which evolution is accepted and the doubt with which even cultured persons are occasionally apt to view this conception of nature arise chiefly from lack of knowledge concerning the overwhelming evidences of its existence which natural history presents. Doubtless, a training in botany and zoölogy is required before the case for evolution can be fully mastered, but there need be no difficulty in the way of any intelligent person forming a just estimate of evolution upon even an elementary acquaintance with the facts of biology. I have accordingly sought to bring such facts prominently before the notice of my readers, and I would fain hope that even the complex topic of 'development' itself, a strong pillar of the theory of evolution, is susceptible of easy appreciation when the facts and inferences to be drawn therefrom are plainly stated."

YOUTH: ITS CARE AND CULTURE. An Outline of Principles for Parents and Guardians. By J. MORTIMER-GRANVILLE. New York: M. L. Holbrook & Co. Pp. 167.

THE author is known as a thoughtful and vigorous writer on subjects of practical hygiene and discipline. The aim of his present work is to expose "certain fallacies" which prevail on the subject of child management and education, and to indicate, "in suggestive outline," the principles which should guide parents in the care and culture of youth. He considers the physical and moral training of boys and girls, advocating the allowance of the freest scope for physical growth in both sexes, with a "hardy" treatment and no coddling, and a particularity in moral culture which is as strange to the general society of the day as it is much needed.

DRESS AND CARE OF THE FEET. By Dr. P. KAHLER. New York: G. P. Putnam's Sons. Pp. 37.

DR. KAHLER believes that chiropody should be recognized as a profession, and that those who intend to practice it should be scientifically qualified for their vocation. He enforces the importance of caring for the feet, a healthy condition of which is considered very closely connected with happiness and the soundness of the whole body, and particularly of the brain and nervous system. His manual consists chiefly of practical suggestions respecting the treatment of diseases and aches of the feet, concerning the care of the feet that will prevent their acquiring diseases and aches, and on the proper construction and form of shoes.

REPORT OF T. B. FERGUSON, A COMMISSIONER OF FISHERIES OF MARYLAND. Hagerstown, Maryland. Pp. 152, with Plates.

THE report describes the work done in the western part of the State during 1880. This work, which includes also the distribution of 1,500,000 shad and 690 carp in waters wholly within the eastern section of the State, under the direction of the Western Commissioner, is regarded as very important, both on account of the success attained in the attempted propagation of several varieties of valuable fish by artificial means, and because of the accumulated proofs which the year afforded of the happy results of the effort fully to restock the waters of the State with shad. A valuable account of experiments and observations in oyster-culture, by John A. Ryder, is added.

SIXTH ANNUAL REPORT OF THE STATE BOARD OF HEALTH OF WISCONSIN. 1881. Madison, Wisconsin. (J. T. Reeve, Appleton, Secretary.) Pp. 146.

THE health of the State was generally good during the year, notwithstanding the unusually large number of deaths from diseases of the respiratory organs among old people, caused by the severe winter of 1880–'81. The history of the various contagious diseases which appeared is reviewed. Especial attention is given to the condition of the schools and school-houses, in respect to which the board trust that the beginning of a change for the better may be seen, the end of which shall be that the improvements which are demanded shall receive the consideration due to them, and "the child shall be recognized as a being of higher value than the grade, rather than as subordinate thereto."

FIRST ANNUAL REPORT OF THE BOARD OF HEALTH OF DETROIT. 1882. Detroit, Michigan: O. W. Wight, Health-Officer.

THE report appears in the form of a "frank, earnest discourse to citizens on subjects of sanitary importance at home," rather than of a scientific discussion of hygienic concerns. Among the subjects considered are the board's system of dealing with contagious and infectious diseases; the preventive management of small-pox; the sewerage and house-drainage system of Detroit; the question of slaughtering in the city; the administrative method in the case of the abatement of nuisances; the purity of the ice-supply; the milk-supply; the "smoke nuisance"; and the water-supply. Other equally important subjects are reserved for future reports.

VAN NOSTRAND'S SCIENCE SERIES, Nos. 59, 60, and 61. RAILROAD ECONOMICS, by S. W. ROBINSON, C. E.; STRENGTH OF WROUGHT-IRON BRIDGES, same author; POTABLE WATER AND THE RELATIVE EFFICIENCY OF DIFFERENT METHODS OF DETECTING IMPURITIES, by CHARLES WATSON FOLKARD. New York: D. Van Nostrand. Pp. 131, 175, 138. Price, 50 cents each.

MR. ROBINSON'S "Railroad Economics" is the fruit of an official tour of inspection under the direction of the State Commissioner of Railways, over the railroads of Ohio, and is intended to bring out such facts observed, and call attention to such features of practice, as shall assist in the attainment by railroads of a uniform standard of excellence. The second work, which has also been prepared in connection with the State railway inspection service of Ohio, furnishes practical formulas for beams, struts, columns, and semi-columns, as calculated by the author in the performance of his work of examining bridges for strength and trustworthiness. The formulas are not otherwise generally accessible in published form. Mr Folkard's "Potable Water" is the substance of an essay originally presented to the British Institution of Civil Engineers, and considers the various ways in which water becomes contaminated; the methods employed to detect and determine the extent of contamination, and their value; the bearing of the results of biological and microscopical research on the question, and the adequacy or inadequacy of proposed remedial measures.

OTTAWA FIELD NATURALISTS' CLUB. TRANSACTIONS No. 3. Ottawa, Canada. (W. Hague Harrington, Secretary-Treasurer.) Pp. 66, with Two Plates.

THE record is for the year ending March 21, 1882. The club has one hundred and fifteen members. Four excursions were held during the summer; a *conversazione* was given on the 6th of January, and a lecture on the "Capabilities of the Prairie Lands of the Northwest, as shown by their Flora and Fauna," was delivered by Professor Macoun, on the 7th of April. Reports of the geological, botanical, entomological, ornithological and oölogical, and conchological branches are included among the Transactions, with papers on the "Geology of the Ottawa Palæozoic Basin," "Pine Life," "The Utica Slate," and other subjects.

REPORT OF THE BOARD OF COMMISSIONERS OF THE NINTH CINCINNATI INDUSTRIAL EXPOSITION, 1881. (J. R. Murdoch, Secretary, Cincinnati.)

THE Ninth Exposition is believed to have far exceeded in completeness and novelty all that preceded it. The departments of Art, Horticulture, and Natural History, were full of interest and attractiveness, and the expert tests of machinery, a new feature, added greatly to the attractions of that department.

THE AMERICAN CITIZEN'S MANUAL. Part I. Edited by WORTHINGTON C. FORD. New York: G. P. Putnam's Sons. Pp. 146. Price, $1.

THIS is the fifth of Messrs. Putnam's series of hand-books on "Questions of the Day." It gives plain statements for the information and guidance of citizens, on the nature, distribution, and functions of our governments, national, State, and local, the electoral system, and the regulations surrounding the exercise of the franchise and the verification of the results, and the character of our civil-service administration. The present condition of civil-service abuse and the need of reform are clearly shown under the last head. A succeeding volume will more fully consider the functions of government.

PRACTICAL LIFE AND THE STUDY OF MAN. By J. WILSON, Ph. D. Newark, New York: J. Wilson and Son, Publishers. Pp. 390. Price, $1.50.

A VOLUME of sober essays on topics relating to one or the other of the subjects mentioned in the title, expressed in plain language and pleasant style. The author's object is simply to interest and instruct those who are seeking improvement, by bringing to notice, on the subjects considered, the best thoughts in the language, in his own words, when they have seemed fitting, in the words of others, where they expressed them best. The work has been done not to make a book, but because the author, as he remarks, "feels that he knows much that ought to be written," and with assurance, "because he has studied what he says, and has confidence in his statements."

SCHELLING'S TRANSCENDENTAL IDEALISM. A Critical Exposition. By Professor JOHN WATSON, LL. D., of Queen's University, Kingston, Canada. Chicago: S. C. Griggs & Co. Pp. 250. Price, $1.25.

THIS is the second of the series of "German Philosophical Classics," which Messrs. Griggs & Co. are publishing, under the general editorial supervision of Professor George S. Morris, of the University of Michigan. In the present volume the editor has endeavored to exhibit the phases of Schelling's philosophical development as they are registered in the various treatises which form their vehicle, supplying all the elements for an independent judgment, together with some hints of weak points of the system.

SPEECH AND ITS DEFECTS, CONSIDERED PATHOLOGICALLY, HISTORICALLY, AND REMEDIALLY. By SAMUEL O. L. POTTER, M. A., M. D. Philadelphia: P. Blakiston & Co. Pp. 117. Price, $1.

THE first prize was accorded to this work as a thesis by the unanimous vote of the faculty, at the fifty-seventh annual commencement of the Jefferson Medical College, Philadelphia. The author selected the subject for his prize thesis, because it was one on which from his own sufferings and experiments he felt "somewhat qualified to write," and could contribute to knowledge; for he had made, in his own person, practical trial of several of the recognized methods of cure, and had examined all the attainable literature on the subject. We give a note of warning from the author to those who have cases of stammering to deal with: "The ignorance of this subject which prevails among those having the care of children, is productive of much distress and serious results to the innocent sufferers. The child who manifests a disposition to stutter is usually abused in more ways than one. The affection is intensified by any cause which disturbs the equipoise of the nervous system; and the most frequent and potent cases of this kind are derived from the reception which his infirmity receives from those who are endowed with perfect speech themselves. Mockery on the part of companions, and threats, even blows from parents and teachers, have made more confirmed stutterers than any other extensive influence, besides making the life of the patient one of unutterable wretchedness."

THE MAGAZINE OF ART. London, Paris, and New York: Cassell, Petter, Galpin & Co. December, 1882. Monthly. $3.50 a year.

WE have received Messrs. Cassell, Petter, Galpin & Co.'s "Magazine of Art," as it has appeared in monthly numbers through the year, with much satisfaction, and are pleased to commend it as a good representative of what is true and meritorious in art. In its letterpress it teaches what it is well to teach in art, in a manner that appeals to the popular understanding and is likely to elicit popular interest. Its illustrations are selected with discrimination from worthy and agreeable subjects, and are well executed, while the typography is nearly perfect. Its articles are varied in subject and method, and its news and other departments are acceptably sustained; and a fair degree of attention is given to American art. In the December number some of the American pictures at the *Salon* of 1882 are candidly criticised; articles are given on Japanese book illustration; a subject of prehistoric art; a department of ceramics; the works of an Italian artist; and Mr. Hamerton's "Graphic Arts," all of which are appropriately illustrated.

THE "Revue Scientifique," of Paris, has won a high rank among journals of its class, by the prominent space it gives to the original papers of leaders of scientific thought, and by the international catholicity which it has shown in enrolling among its contributors writers from different countries in Europe and America, including such men as Pasteur, Berthelot, Wurtz, Milne-Edwards, Tyndall, Huxley, Du Bois-Reymond, Virchow, and some of our own men of science. It is edited by Charles Richet, a physiologist eminent particularly in the investigation of nervous disorders. It is published by Germer-Baillière & Co., 108 Boulevard Saint-Germain.

THE next number of the "International Scientific Series" will be on a subject of unusual popular interest, and of extreme importance. It will be on "The Science of Politics," and is contributed to the series by Dr. Sheldon Amos, author of "The Science of Law." The science of politics is a subdivision or branch of social science, the next great subject in the order of scientific progress. The science of politics is therefore in the early stage of its development, and, as its principles are as yet but imperfectly elucidated, no treatise upon it can have completeness, or the authority of perfected elucidation. Nevertheless, the beginning must be made, and already enough is known, both of the data of the inquiry and the method to be employed, to give great interest and value to a well-elaborated popular treatise.

PUBLICATIONS RECEIVED.

Annals of the Astronomical Observatory of Harvard College. Vol. XIII, Part I. Micrometric Measurements. By Joseph Winlock and Edward C. Pickering. Cambridge, Massachusetts: John Wilson & Son. Pp. 203.

Transactions of the Linnæan Society of New York. Vol. I. New York: L. S. Foster. Pp. 168.

"The Decorator and Furnisher," December, 1882. 75 Fulton Street, New York: E. W. Bullinger. Pp. 32. Price, 35 cents.

The Manufacture of Iron and Steel direct from the Ore. "Bull's Process." By Mr. Vaughan W. Jones. Liverpool, England: Andrew Russell. Pp. 15.

Spirits in Prison. A Discourse delivered on a Special Occasion. By George E. Ellis. Cambridge, Massachusetts: John Wilson & Son. Pp. 27.

Proceedings of the American Society of Microscopists. Fifth Annual Meeting. August, 1882. Buffalo: Bigelow Brothers. Pp. 300.

Yellows in Peach-Trees. By D. P. Penhallow. Boston: Rockwell & Churchill. Pp. 8.

Physics, and Occult Qualities. An Address before the Philosophical Society of Washington. By William B. Taylor. Washington: Judd & Detweiler. Pp. 50.

"The Modern Age," January, 1883. Buffalo: Modern Age Publishing Co. Pp. 60. Price, 15 cents.

Contributions to the Anatomy of Birds. By R. W. Shufeldt, M. D. Author's edition. Washington, D. C. Pp. 216, including Plates.

Meteorological Researches. United States Coast and Geodetic Survey. Part III. Washington: Government Printing-Office. Pp. 48.

Signal-Service Tables of Rain-fall and Temperature compared with Crop Production. By H. H. C. Dunwoody. Washington: Government Printing-Office. Pp. 15.

Observations on Fat-Cells and Connective-Tissue Corpuscles of Necturus (Menobranchus). By Simon H. Gage. Buffalo: Bigelow Brothers.

"The American Journal of Forestry." Edited by Franklin B. Hough. October, November, and December, 1882. Cincinnati: Robert Clarke & Co. Pp. 48 each. Price, $3 a year.

Some Thoughts on Phthisis. By M. F. Coomes, M. D. Louisville, Kentucky. Pp. 7. Menstrual Amblyopia. Same author. Pp. 4.

Footprints found at the Carson State-Prison (Nevada). By H. W. Harkness, M. D. Pp. 7, with Plates.

Electric Lighting in Mills. By C. J. H. Woodbury. Pp. 7.

W. H. Cory's Artificial Fuel, and Press for Use in its Manufacture. Philadelphia. Pp. 20.

Standard Time, for the United States, Canada, and Mexico. By E. R. Knorr. Washington: Judd & Detweiler. Pp. 16.

Optical Illusions of Motion. By H. P. Bowditch and G. Stanley Hall. Pp. 10, with Plates.

How to use Florence Knitting Silk, No. 4. Nonotuck Silk Co. Pp. 62.

The Responsibility of Criminal Lunatics. By S. S. Herrick, M. D., Secretary of the State Board of Health, Louisiana. New Orleans. Pp. 7.

Comparative Vital Movement of the White and Colored Races in the United States. By S. S. Herrick, M. D., Louisiana. Cambridge: Riverside Press. Pp. 6.

Miscellaneous Literary, Scientific, and Historical Notes, Queries, and Answers. N. B. Webster, Editor, Norfolk, Virginia. Manchester, New Hampshire: S. C. & L. M. Gould. Double number, December and January. Pp. 32. Price, 20 cents.

Sunlight and Skylight at High Altitudes. By Professor S. P. Langley. Pp. 398.

The Structure of the Muscles of the Lobster. By M. L. Holbrook, M. D. New York City. Pp. 8.

The Disposal of the Dead. By W. H. Curtis, M. D., Chicago, Illinois. Cambridge: Riverside Press. Pp. 22.

How Congress and the Public deal with a Great Revenue and Industrial Problem. By David A. Wells. Pp. 16.

The Termination of the Nerves in the Liver. By M. L. Holbrook, M. D. New York City. Pp. 6.

Fifteenth Annual Report of the Trustees of the Peabody Museum of American Archæology and Ethnology. Cambridge, Massachusetts. Pp. 148.

"Babyland." Holiday number. Boston: D. Lothrop & Co. 1882. Monthly, 50 cents a year. Illustrated.

Carnivorous Plants. By W. K. Higley. First Series. Pp. 60.

"Wide Awake." Boston: D. Lothrop & Co. December, 1882. Monthly, $2.50 a year.

House Drainage and Sanitary Plumbing. By William Paul Gerhard. New York: D. Van Nostrand. Pp. 205. Price, 50 cents.

Poems by Minot J. Savage. Boston: George H. Ellis. 1882. Pp. 247.

Annual Report of the Chief-Engineer of the Water Department of the City of Philadelphia, for the Year 1881. Philadelphia: J. Spencer Smith, printer. 1882.

Tables for the Use of Students and Beginners in Vegetable Histology. By D. P. Penhallow, B. S. Boston: S. E. Cassino. 1882. Pp. 39.

The Builder's Guide and Estimator's Price-Book. By Fred T. Hodgson. New York: Industrial Publication Co. 1882. Pp. 331.

The Elements of Forestry. By Franklin B. Hough, Ph. D. Cincinnati: Robert Clarke & Co. 1882. Pp. 381. $2.

Ragnarok: The Age of Fire and Gravel. By Ignatius Donnelly. New York: D. Appleton & Co. 1882. Pp. 452. $2.

First Annual Report of the Bureau of Ethnology. 1879–'80. By J. W. Powell, Director. Washington: Government Printing-Office. 1881. Pp. 603. Illustrated.

POPULAR MISCELLANY.

Observations of the Recent Transit of Venus.—Professor C. A. Young has published in the "New York Times" a summary of the results, so far as they can be estimated so soon, that have attended the observations of the transit of Venus of December 6th in this and other countries. On the whole, he says, the observations were successful beyond expectation. Although in the United States there was more or less cloudiness, there were very few stations that did not succeed in accomplishing the most essential portions of their intended work. The first contact, although it is the most difficult part of the phenomenon of which to get an accurate observation, and although it was not seen by more than half as many observers as the other three contacts, was noted by some of the observers at twenty out of the thirty-nine stations on the continent where it might have been visible. An unusually satisfactory observation was obtained at Princeton. The other contacts were observed with more general success, the second at twenty-nine, the third at thirty-two, and the fourth at thirty stations. As far as can be judged from the present incomplete calculations, "it would appear that the planet was about 20″ to 25″ behind time in her orbit, and that her diameter assumed in the computations was at least 1″, and probably 1·5″, too large. The duration of the transit appears, also, to have been about 25″ longer than computed, which might indicate either of two things or a little of both—that the planet was 1″ or 2″ of an arc north of its computed position, or that the diameter of the sun is a trifle larger than was assumed. The agreement, however, was remarkably close." Heliometer observations were made by German parties at Hartford, Connecticut, and Aiken, South Carolina, and by Professor Waldo, at Yale College. Measurements of the sun's diameter by similar or somewhat different instruments were also made by the French at St. Augustine, the Belgians at San Antonio, and—with a wonderfully simple but accurate apparatus—at Cambridge and New Haven. Photographs were taken by different methods at a number of places, and with unexpected success, except at Washington. "At Fort Selden and at the Lick Observatory the day was perfect, and the photography went on without a hitch." Micrometric observations for the diameter of Venus were made at fifteen or sixteen stations on this continent, and perhaps at nearly as many more foreign stations. The results are not yet reduced, but the indications correspond with the conclusion, which was drawn from the contacts, that the planet's diameter is really considerably smaller than has hitherto been assumed. The photometric observations showed that Venus was distinctly darker than the sky just outside of the sun's limb. The results of the spectroscopic observations at Cambridge, South Hadley, Princeton, and Alleghany were "purely and surprisingly negative," and showed for the most part no conspicuous evidence of selective absorption by the planet's atmosphere. The Princeton observers, however, were so fortunate as to find distinct indications of water-vapor, thus confirming certain old observations of Huggins. Professor Langley, at Alleghany, observed a spot of abnormal brightness in a part of the atmosphere of the planet where such an appearance would be least expected, which may denote auroral and magnetic phenomena. Professor Harrington, at Ann Arbor, made out spots and markings on the planet's disk, but no one else has spoken of

them. In Europe the weather was generally bad. Good observations were made, however, at Potsdam, Prussia. The reports so far received from the southern hemisphere are most gratifying; and, whatever it may be with the stations yet to be heard from (chiefly near the Straits of Magellan), "enough is already secure to make it certain that we have observations sufficient in number and character to test the full value of the transit as a means of determining the solar parallax." It must be several years, however, before the observations can be fully reduced and published, and the exact results ascertained.

Work of the Dearborn Observatory.—The great equatorial of the Dearborn Observatory, Chicago, was employed during 1881, under the direction of Professor G. W. Hough, chiefly in the observation of the great comet of the year, the planet Jupiter, the satellites of Uranus, and difficult double stars. A drawing of the nucleus and envelope of the comet, showing the peculiar formation of the head and surrounding envelopes, was made on the 23d of June by Professor Colbert, who also first announced the distance of the comet from the earth. In attempting to reconcile the various phenomena alleged to have been seen on the disk of Jupiter, the greatest difficulty is found to exist in determining what is real and what is imaginary. Contemporaneous sketches by different persons, or even two by the same observer, show such marked discrepancies that they are of but little use in ascertaining suspected changes. The observations made here during the past three years confirm the statement that the changes on the disk of the planet are slow and gradual. The attempted observations on the inner satellites of Uranus were impeded by unfavorable night weather. About two hundred and fifty micrometer measurements of double stars were made, including nine measurements of the companions of Sirius. Sixty difficult double stars, not found in the catalogues, were discovered, including two quadruple systems and one naked-eye star, with a very minute companion. Mr. S. W. Burnham is preparing for publication a catalogue of one hundred and fifty-one double stars discovered at the observatory during the past three years; also, a compilation of all the star observations made by him during the same period, comprising about twenty-five hundred measurements. The observatory is open to members of the Chicago Astronomical Society on Thursday evenings; and classes from the city high-schools and elsewhere are occasionally admitted.

The Poles of Extreme Cold.—There appear to be two districts on the northern hemisphere, widely separated from each other, in which the coldest places on the earth are to be found. One is in Northeastern Siberia, the other in the American Arctic Archipelago. The particular points within these regions, that have the property of being colder than all surrounding points, may be called the poles of extreme cold. Their geographical situation is not precisely ascertained, because a sufficient number of observations have not been made, but enough is known to make it safe to conclude that the Asiatic pole is north of Yakutsk, and the American pole northwest of the Parry Islands, toward Eastern Siberia. The Asiatic pole is upon the mainland, the American pole in a sea studded with islands; and from this the two regions derive distinct climatic characters. Near the Siberian pole, which lies in the comparatively low latitude of from 60° to 70°, the continental climate is exhibited in an extremely cold winter and a warm summer, while the more maritime climate of the American pole, which lies between 65° and 68° of latitude, is expressed in a relatively milder winter and cooler summer. Yakutsk has hitherto been considered the coldest place on the earth, it having a mean temperature in January of −45°. Colder places have since been found that have a mean temperature for January as low as −55°. They are situated in about latitude 67½° north, near Werkojansk, in Siberia. The cold-pole is located here from November till March; it then moves in April and May toward the northwest into the Arctic Ocean, between the mouth of the Obi and Nova Zembla, and afterward returns to Werkojansk. Werkojansk is the only place that lies within the isotherm of −40° during November, December, January, and February, or for four

months; Yakutsk suffers this mean temperature during December and January; Ustjansk, at the mouth of the Yana, only during January; while Tolstoi Noos, at the mouth of the Yenisei, lies entirely outside of the isotherm of — 40°. The mean annual temperature of the Siberian cold-pole may be estimated at 2°. A still colder place appears to have been found by M. Klutschak, of Lieutenant Schwatka's expedition, at the Adelaide Peninsula, in Cockburn Bay, latitude 66° to 68°, where the temperature in January, 1880, reached — 72°; in December, 1879, and February, 1880, — 68°; and in September, October, and November, 1879, 5°, — 38°, and — 49° respectively. The mean temperature from December to February, — 48°, varies but little from that of Werkojansk, and is from 18° to 21° lower than had been previously noticed in the American cold region.—*Die Natur.*

Do House-Flies convey Infection?—Dr. Thomas Taylor, of Washington, has published an account of some examinations he has made into the capacity of the common house-fly to transmit disease by carrying the germs from place to place. The question is really one of exceeding importance, for, "considering the habits and habitat of the house-fly, it will appear evident that, should it prove to be a carrier of poisonous bodies, its power to distribute them in human habitations is greater than that of any other known insect. Under our system of public travel, the common house-fly may be transported from one end of the continent to the other. It may feast to-day in the markets of Washington, and to-morrow in those of New York, and in a like manner it may be transported from a hospital for contagious or infectious diseases to homes in the vicinity, or even in remote localities. It may also be taken from one hospital to another, or from one ward to another within the same hospital, and may plant the germs of disease in exposed wounds, or deposit them in food, or liberate them in the atmosphere breathed by patients afflicted by diseases of a different class." Millions of the minute germs of putrefaction could be carried to a distant city by a single fly. These considerations justify and should prompt inquiry. Dr. Taylor's attention was called to the subject by his witnessing the sufferings of a fly afflicted with *anguilulæ*. In the direct experiments which were suggested to him by this observation, the larvæ of flies confined in a receiver with rust-spores ate the germs. When spores were sprinkled on sugar, the insects themselves consumed both spores and sugar; but some of the spores became fastened on the legs of the flies, and were only the more closely attached by the efforts made to get rid of them. They might, however, be brushed off by objects with which they were brought in contact, while their germinating powers would long outlast the life of the insect itself. Dr. Taylor regards it as evident from his experiments that flies are capable of conveying spores to plants and other bodies, but considers that the fact that the greater part of the spores were consumed by the flies or their larvæ shows that the insect may destroy microscopic germs as well as disseminate them, and indicates that in some cases its agency in keeping down their number may more than counterbalance its action in contributing to their dissemination.

American Stature.—Mr. George W. Peckham, teacher of biology in the Milwaukee High School, has been making investigations under the auspices of the Wisconsin State Board of Health into the growth of children. From examinations and measurements made chiefly in the schools of Milwaukee he has deduced the conclusion that the relative rate of growth of the sexes is such that the boys are taller till the twelfth year and heavier till the thirteenth, after which, between thirteen and fifteen the girls are both taller and heavier. After the age of fifteen, however, the boys exceed the girls both in weight and stature. Girls cease to grow when about seventeen years of age. Children of pure American descent are taller than children of foreign-born parents, but are generally lighter in weight than children of German parents. The children of Irish parents are also taller than those of German parents. Comparing his results with those of similar observations made in Boston, he concludes that school-children in Milwaukee are taller than those in Boston, and the boys weigh more, but the girls of Boston are slightly heavier than those of Milwaukee. The su-

periority in height of the Milwaukee children is ascribed to the inferior density of population and the existence of fewer urban disadvantages in that city than in Boston; and the general hypothesis is drawn, from Mr. Peckham's tables, that the height of American-born men is more modified by the conditions accompanying density than by all other influences, race excepted, urban life as compared with rural life tending toward a decrease of stature. The rate of growth of Germans appears to be considerably modified by residence in this country through one generation; and, in intermarriage between Americans and Germans, the offspring seem to take the height of the taller parent.

Use of the Gummy Secretions of Plants.—Inquiry has often been made respecting the functions of the secretory apparatus of plants, or that which stores up special juices, such as the resins, gums, caoutchouc, milky juices, and the waxes. Sachs, even in the last edition of his botany, places these substances among those the office of which in the economy of the plant is wholly unknown. Because the secretions in question have been observed to be poor in oxygen and generally unassimilable, they have commonly been regarded as waste matter, useless to the organism. M. de Vries is of a different opinion, and regards these substances as a kind of protective salve, and considers them helpful in the healing of wounds. Of the resin of conifers, he remarks that, if it were simply a product of secretion, the accumulation of it would not cause the tree to suffer. The extraction of resin, however, weakens pines very considerably, and diminishes the growth of wood by about one third. Accidental wounds, moreover, and even normal wounds produced by the fall of limbs or by splitting of the bark, are very numerous in conifers. Whenever a wound is produced, it is forthwith covered over with a viscous and thick mass of resin, which gradually hardens in the air. Among non-resinous plants wounds become isolated by means of a pad of healing tissue which sometimes covers the wound completely over, but often too late to effect the purpose. From this point of view, M. de Vries suggests, the conifers are superior in organization to common angiospermous trees. The organism in coniferous trees seems in a manner to have foreseen possible wounds, and a system of canals designed solely to furnish a covering for wounds seems to have been differentiated in them. In a second part of his work, M. de Vries treats of the function of the juices analogous to the resins which are found in other plants, and seeks to assimilate to the resins, from different points of view, the latex, some of the gums, caoutchouc, and waxy matters. He shows that these substances also exude for the occlusion of wounds, even in herbaceous plants like the northern chicories and spurges, and cites some recent experiments by M. Moll in favor of his view. It would, however, be a narrow judgment to conclude with him, from these experiments, that the sole object of the secretions is the healing of wounds. M. Raumhoff, criticising the work of M. de Vries, has shown that the considerations on which his theory rests do not furnish an adequate demonstration of it. It is evident, for instance, that the purpose of the lactiferous tissues can not be solely the healing of wounds, for these tissues in the spurges contain starch, a substance that does not assist in that office, and which is not a product of secretion. The studies of M. Treub on the tropical spurges furnish evidence that one of the probable offices of their lactiferous tissues is the conveyance of starch.

The Possible Annual Yield of a Forest.—The basis on which all sound forest management depends, says Colonel G. F. Pearson, is the revenue which any forest can be made to pay—that is to say, the income which it will produce in proportion to the volume of the standing trees, or, in other words, its capitalized value. To this end a forest should be considered as so much capital, represented by so many cubic feet of wood; while the amount of wood produced each year, by its growth, represents the interest thereon, and, in fact, is the revenue of the forest. It is evident that it is possible to cut and remove every year a quantity of timber equal to this annual increase of wood, without diminishing the volume of the standard crop. The possible annual yield of a forest may be estimated on the basis of a calculation that a tree, ten feet in

girth, which makes a ring of wood of only one eighth of an inch in thickness, adds to its bulk at the rate of rather more than one cubic foot of timber annually for every ten feet of the length of its stem; or, in other words, such a tree, if its stem be thirty feet in height, will, in thirty years, have increased in bulk by at least one hundred feet of solid timber. At the same time, during these thirty years, the young trees which are springing up will have become perfectly hardy, and capable of supporting the whole force of the summer heat and winter frost.

Marriage Customs of the Kacheen.—Mr. R. Gordon, who has been exploring among the sources of the Irrawaddy River, has given to the Royal Geographical Society some additional facts concerning the marriage customs of the Kacheen, the curious Burmese tribe who were described by Lieutenant Kreitler in the July number of "The Popular Science Monthly": "When a man and woman set up house, the man has to give to the parents of the woman cattle, pigs, gongs, muskets, *das*, slaves, clothes, spears, and money; and for his wife's use he has to give coral beads, *tameings*, jackets, broadcloths, etc., according to his circumstances. After the gifts the woman is brought to the man's house, and the man has to feast the bringers of the woman with rice, and curry, and spirits, and liquors. To the elders, also, he has to give blue waist-cloths, turbans, *das*, or spears, according to their degree. The man then shows the woman all the work to be done in the house, and bids her do the work. After having lived together for a long period, if the man dies, the woman can not marry any one; but the elder or younger brother has to set up house with her. If there be no brother, the deceased man's father (the woman's father-in-law) takes possession of her, and makes her his wife. If an elder brother dies, the younger brother takes over his wife. If the father dies, the son takes over his father's wives, and makes them his own, except his own mother. If a wife dies, the husband goes to her parents and asks for another wife, and they have to give him her elder or younger sister—a woman who is unmarried. If there be no sister to give, they have to give a female relative. Husbands and wives must not be at enmity with each other. Divorce is unknown as a custom. However bad husband or wife may be, they can not separate, unless, in the case of the husband, he gives double the amount of what he originally gave her, and, in the case of the wife, unless she gives quadruple the amount she originally received. If the man sets aside his wife and takes another, the head wife has the right to take possession of all the property of the younger wife, as well as to sell her. The young unmarried men and women, so long as they are not brothers and sisters, act as they please inside the apartments of the house." The Kacheen women wear waist-cloths dyed black and blue, five hands long and not very wide. The jackets are close-fitting, and over them they have a looser one set off with cowries. This is probably full dress. Round their waists they have perforated cowries on three or four hoops of rattan. From their knees down to their calves they wear hoops of rattan. Some women, the wives of the principal men, tattoo their legs from the knee to the ankle.

European Technical Schools.—Mr. Edward C. Robins has presented to the British Society of Arts the results of the inquiries he has made into the causes of the differences in the degree in which different countries have profited from technical education. The clew is not found in differences in primary education; but, when the provisions made in foreign colleges for higher education are examined, something will be found in them so superior to anything in England as to afford a lesson of value. The intellectual and social condition of the industrial population, he premises, and the character of the education it should receive to fit the national mind to cope with the national progress, can not be met by an extension of scholastic institutions, based on the requirements of the middle ages. Yet this is the principle which has dominated the universities, "and, until very lately, no concessions have been made to the reasonable demands of progressive civilization." Secondary and primary education are left in no better condition with reference to this point. The improvement in the technical education of

the masses, however, which has begun in the board schools, and is destined to widen, will necessitate a like improvement in all the grades above them. The English are nevertheless gaining in artistic development, and the freedom of choice and the individuality of the English artist are beginning to tell abroad, and English taste in architecture and ornamental design is rapidly supplanting Continental. It is to England that Germans come for Christmas-cards, original ornamental pottery, patterns for embroidery, etc.; "and, in Vienna lately, I could scarcely buy a souvenir that was not adorned with cuttings from Kate Greenaway's charming crudities." The Royal Commissioners on Technical Education show in their reports that, among the French, it is not in the technical education of the ordinary working-classes that the differences sought are to be found; and the reports of the French commissioners reveal a state similar to that prevailing in England, so far as their ordinary workmen are concerned. Schools of arts and trades have been established, but their pupils expect to be foremen, not workmen. Apprenticeship schools have also been started, with more promising results. The best and most successful technical schools are in Switzerland and Germany, and conform, as a rule, to Professor Ayrtoun's definition, that they are not a school where the manipulation or routine of a trade is taught, but one where a lad receives general instruction in the principles of applied science, and special instruction in the application of those principles to the particular trade he is following, or which he is about to follow. In them everything is taught that can be gained at the universities, except the dead languages, while modern languages and the applications of modern science to art and industry are added, with such thoroughness that nearly all the leading men of England have found it desirable to spend some years in Germany. In the *Polytechnikum* at Zürich, Professor Meyer teaches chemistry in a purely scientific direction, irrespective of any practical application; then Professor Lunge treats the chapters which refer to practical applications, at greater length, and enters into a number of details relating to various chemical industries, placing the technical side foremost, but laying the principal stress on explaining the scientific principles underlying the applications. Models of every kind of mechanical action and of every kind of machine are found, but manual labor is excluded; while the student in architecture, for instance, has to work out the strains of every floor or roof or specialty in construction, and to delineate the same in skeleton diagrams attached to every plan he draws; and the mechanical draughtsman is not given a subject to copy, but only the parts of a machine, which he has himself to piece together, thus thoughtfully working out in practical draughtsmanship the theory he has been taught to apply constructively. The highly educated young men from these *polytechnikums* finally become masters when they can, but are not ashamed, till then, to act as foremen of manufactories, etc.

M. Respighi on the Light of Comets.—M. Respighi, admitting the fact that a part of the light of comets is due to the reflection of solar light, is of the opinion that it is yet too soon to decide that any part of it is a proper light due to the comet's own incandescence. He believes that the discontinuity of the comet's spectrum, and the bright lines or bands, may proceed from light modified by passing through the masses of vapors or gases, of which the cometary bodies are composed. It is certain, he observes, that a large part of the cometary light comes from the interior of the bodies, and passes through extensive strata of vapors, in which it is subjected to a selective absorption that causes it to give lines different from the Fraunhofer lines of the sun. So we may have both the weak but complete spectrum produced by the light reflected from the outer strata in which the absorption has been insensible, and another spectrum coming from the deeper parts, with which the absorption has been greater. This view is confirmed by M. Respighi's spectroscopic observations of comet *b*, 1881. The phenomenon, he observes, is of a similar nature to that of the dark bands of the spectrum of the sun in the horizon, but is greatly exaggerated in the case of the comets by the enormous volume of the vapors, the richness of their chemical composition, and the feebleness of the light they reflect.

Nerve-Vibration as a Remedy.—Dr. J. Mortimer-Granville writes in the "Lancet" that enlarged experience in nerve-vibration, as a means or method of treating disease, has confirmed his belief in its value, and he has no longer any hesitation in recommending its adoption by the profession. He has employed it in a very considerable number of cases, differing widely in their nature and characteristics, and, although he has had many failures—mainly, as he believes, from errors in diagnosis, and mis management in the application of the treatment—"the net result has been such as to place beyond reasonable question the fact that, in precisely applied mechanical vibration of nerves and nerve-centers, we have a means of eliciting function and stimulating nutrition which surpasses for directness and rapidity of action any other system or method extant." Regarding the principles of the practice, Dr. Mortimer-Granville believes that, in the treatment of neuralgia, percussion acts simply by interrupting a morbid series of vibrations and substituting for it another series which is not morbid. Its success is by no means certain; but it deserves a trial, and particularly in cases which would otherwise be treated by nerve-stretching. The method is believed to be of the highest possible value for the rousing of torpid nerve-centers and eliciting function from the several organs of the body. Every organ "may, in the absence of disabling organic disease, be made to perform its proper function by exciting the nerve which supplies it with energy by mechanical vibration. In this way I have seen the liver unloaded, and what seemed to be inveterate torpidity of the intestines remedied in a few successive vibrations. I have now under treatment the case of a child who was six weeks ago to all appearance an idiot, but who has already developed so much cerebral activity and growing intelligence, under the influence of specific center and nerve-vibration, that I entertain the strongest hope of his ultimate awakening, and a fair approach to the normal state. A surprising amount of success has attended percussion in cases of obstinate and what was supposed to be irremediable deafness. . . . In neurosthenia, neurasthenia, and even commencing sclerosis of the spinal cord with loss of tendon reflex, the most remarkable effects are produced by applying the *percuteur* over the spinous processes of the appropriate vertebræ."

Obituary.—Science, in California, lost by the death of the Hon. Benjamin B. Redding, State Fish Commissioner, in August last, one of its most active promoters. Mr. Redding was a Regent of the University of California, and President of the Board of Trustees of the California Academy of Sciences. He took great interest in all scientific work, especially in the paleontology of the Pacific coast, and was an indefatigable collector of prehistoric and aboriginal relics. He was also a member of the Geographical Society of the Pacific, and read before it in April last a paper describing a visit to the Galapagos Islands, made in 1850. A list of his contributions to current literature since October, 1877, contains the titles of more than eighty papers, nearly all of which had a scientific bearing. No record is preserved of his previous contributions. His papers have been described as always full of original facts, clearly and simply expressed. Mr. Redding was fifty-eight years old.

NOTES.

A POWERFUL magnetic storm prevailed, both in the United States and England, shortly after the middle of November, reaching its intensity in both countries on the 17th. It was described by American electricians as unlike any disturbance heretofore known, and as acting upon the wires in strong waves, which produced constant changes in the polarity of the current. In England, Mr. Preece pronounced it the most terrific storm he had ever witnessed, after thirty years of observation, and described it as characterized, like the American storm, by alternate waves of great strength. The storm was accompanied, in both countries, by brilliant auroras on the night of the 17th. French accounts represent the storm as equally remarkable on the Continent.

THE death is announced of Dr. Franz Ritter von Kobell, Professor of Mineralogy, and keeper of the mineralogical state collections at Munich, Bavaria. He was seventy-nine years old, and was well known through his numerous mineralogical publications.

M. MELSENS, a Belgian physicist, has suggested that objects which it is most important to protect from lightning, like powder-magazines, should, besides being furnished with lightning-rods, be wholly surrounded with a metallic net-work. He rests upon the fact that animals in such inclosures never experience any mischievous effects from discharges which must, under ordinary conditions, have stunned them. A correspondent of the French Academy of Sciences asserts that trees that have been struck by lightning have, for many years afterward, the same effect upon the compass that magnetized bodies have. The statement needs verification.

M. G. LE BON has called attention to two new and very effective antiseptics, the glyceroborate of calcium and the glyceroborate of sodium. They are both very soluble, odorless, and unpoisonous, and deliquesce rapidly when exposed to the air. They are powerful antiseptic agents, even in very dilute solutions. The calcic salt appears to be the more effective of the two, in a therapeutic point of view, and may be applied, even in strong solution, and to so delicate an organ as the eye, without bad results. These salts have been proved to be excellent preservers of meat during a South American voyage.

IT is not Professor Louis Palmieri, as stated in our last number, who is dead, but his nephew, Marino Palmieri, Professor of Physics in the University of Naples, and also well known for his seismological researches. We referred the death to the older Palmieri through an error in the balancing of probabilities. The English journal, "Nature," contained a notice of the death of the younger Palmieri, at the early age of thirty-two years; the French journal, "La Nature," of about the same date, gave the obituary as of Luigi, the septenarian. Considering both publications entitled to an equal degree of respect, we regarded the probabilities as in favor of the death of the elder one, who had passed the age of threescore and ten.

THE new volume in the French edition of the "International Scientific Series" is on the "Origin of Cultivated Plants," by M. de Candolle. It appears from this author's researches that, out of about 40,000 known species of plants, mankind make use of only about three hundred.

THE Marquis of Nadaillac, author of a famous work on "The First Men," has just completed a work on "Prehistoric America," published by G. Masson, Paris, which, according to "La Nature," is the first complete work on America prior to the Spanish Conquest that has been placed within the reach of the French reading public.

IN "The Popular Science Monthly," vol. v, page 198, mention is made of an immense Japanese spider-crab in the cabinet of Rutgers College, New Jersey, which measures eleven feet six inches when extended. It is the *Macrocheira Camperi*. It was for many years the largest specimen known in any collection. Since then one ten feet long was taken to Edinburgh. A specimen is now advertised for sale in London, which measures over fifteen feet in length! The strange thing is, its owner appears to be ignorant of its name.

THE international series of stations, for the examination of the polar regions and phenomena, have been completed, and the designated posts have all been occupied by the parties representing the several states to which they were assigned. The United States is represented at Point Barrow and Lady Franklin Bay, by parties under Lieutenant Ray and Lieutenant Greeley; Great Britain and Canada, at Fort Rae; Germany, at Cumberland Gulf and the South Georgian Islands; Russia, in Nova Zembla and at the mouth of the Lena; Austria, at Jan Mayen; France, at Cape Horn; and Denmark, Sweden, Norway, Finland, and the Netherlands, at other points in the Arctic regions.

ON the 25th of July, 1881, the British Indian Survey observed an extraordinary outburst of solar spots, covering 630,000,000 square miles. The phenomena were all observed within a period of thirty-seven minutes. Says "Nature," "It is rare that so grand an outburst is so closely located in time."

THE citizens of Montreal have begun their preparations to receive the British Association in 1884, by sending out circulars to inform their invited visitors that the city can take care of them, and that they will find their visit a pleasant one. Among the inducements held forth are easy excursions to Quebec and Ottawa, and longer and pleasant ones to Toronto, Niagara Falls, Boston, New York, and New Haven, or whatever Eastern city the American Association may meet in. The Government of the Dominion is expected to make liberal grants of money to defray the expenses of British members, the railroads and steamboats will provide excursions to the Great Lakes and Chicago, and to the provinces of the Northwest as far as the Rocky Mountains; and the Association is promised its usual revenue from the meeting.

THE extreme western boundary of the United States is in the Island of Attoo, as far beyond San Francisco as that city is from Maine. San Francisco is thus only the half-way station in the journey across our country.

SIR CHARLES WYVILLE THOMSON.